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OF THE

MADRAS GOVERNMENT MUSEUM

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THE MOLLUSCA OF KRUSADAI ISLAND
(IN THE GULF OF MANAAR)

II.—SCAPHOPODA, PELECYPODA AND CEPHALOPODA

BY

S. THOMAS SATYAMURTI, M.A., D.SC., F.L.S.
(Curator, Zoology Section, Madras Government Museum)

***NEW SERIES**—Natural History Section, Vol. I, No. 2, Part 7*

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(*Published — December 1956*)

CONTENTS

PAGE
Introduction .. 1

Class SCAPHOPODA—

Family Dentaliidae .. 2

Class PELECYPODA (= BIVALVIA)—

Key to the families of Pelecypoda .. 7

Order TAXODONTA—
Series NUCULACEA—

Family Nuculanidae (= Ledidae) .. 16

Series ARCACEA—

Family Arcidae .. 17
Family Glycimeridae .. 27
Family Limopsidae .. 28

Order ANISOMYARIA—
Series MYTILACEA—

Family Mytilidae .. 29

Series PTERIACEA—

Family Isognomonidae (= Vulsellidae) .. 42
Family Pteriidae .. 48
Family Pinnidae .. 53

Series PECTINACEA—

Family Pectinidae .. 57
Sub-family Plicatulinae .. 57
Sub-family Pectininae .. 58
Sub-family Spondylinae .. 62
Family Limidae .. 64

Series ANOMIACEA—

Family Anomiidae .. 65

Series OSTRACEA—

Family Ostreidae .. 66

Order EULAMELLIBRANCHIATA—
Sub-order HETERODONTA—
Series ASTARTACEA—

Family Crassatellidae .. 70

Series CARDITACEA—

Family Carditidae .. 71

Series LUCINACEA—

Family Lucinidae .. 74

Series ERYCINACEA—

Family Erycinidae (= Galeommidae) .. 81

Series CHAMACEA—

Family Chamidae .. 84

PAGE

Class PELECYPODA (= BIVALVIA)—
Order EULAMELLIBRANCHIATA—
Sub-order HETERODONTA—
Series CARDIACEA—
Family Cardiidae 89
Family Tridacnidae 97

Series VENERACEA—
Family Veneridae 98
Family Petricolidae 134

Series MACTRACEA—
Family Mesodesmatidae 135
Family Mactridae 137

Series TELLINACEA—
Family Donacidae 143
Family Semelidae 150
Family Tellinidae 153

Sub-order ADAPEDONTA—
Series SOLENACEA—
Family Solenidae 157

Series MYACEA—
Family Aloididae (= Corbulidae) 160

Series GASTROCHAENACEA—
Family Gastrochaenidae (= Rocellariidae) 161

Series ADESMACEA—
Family Pholadidae 166

Sub-order ANOMALODESMATA—
Series PANDORACEA—
Family Laternulidae 172

Series CLAVAGELLACEA—
Family Clavagellidae 173

Class CEPHALOPODA—
Sub-class DIBRANCHIATA—
Key to the families of Dibranchiata 175

Order DECAPODA—
Series SEPIACEA—
Tribe OIGOPSIDA—
Family Spirulidae 176

Tribe MYOPSIDA—
Family Sepiidae 177

Series LOLIGINACEA—
Family Loliginidae 180

Order OCTOPODA—
Sub-order INCIRRATA—
Series OCTOPODACEA—
Family Octopodidae 183

References to Literature for Scaphopoda, Pelecypoda and Cephalopoda 187
Index 191

THE MOLLUSCA OF KRUSADAI ISLAND

(IN THE GULF OF MANAAR)

II.—SCAPHOPODA, PELECYPODA AND CEPHALOPODA

By S. Thomas Satyamurti, M.A., D.Sc., F.Z.S.

The present work is based upon a detailed study of the material of Scaphopoda, Pelecypoda and Cephalopoda from Krusadai Island and its vicinity, comprising both spirit-preserved and dry specimens, contained in the Molluscan collections of the Madras Museum, which have been considerably enriched in recent years by repeated collections made in this area by the staff of the zoological section of the Museum, and by the addition of an extensive collection of shells donated by the late Mr. M. D. Crichton. This volume is a sequel to the previous one on the Mollusca of Krusadai Island, published as a Bulletin of the Madras Government Museum (*Natural History Section*, **I**, **No.** 2, **Pt.** 6, **1952**), which deals with the Amphineura and Gastropoda of Krusadai Island, and as most of the general remarks on the Mollusca of the Pamban area made in the introductory note at the commencement of that paper pertain to the groups included in the present volume as well, it is perhaps needless to repeat them here.

In the general mode of presentation of the subject, and in the preparation of the descriptions of the species, lists of references to literature, synonymies and diagnostic keys for identifying the various families, genera and species dealt with in this paper, I have followed exactly the same style as in the previous paper, and, again, as in that volume, the classification adopted is in the main that of Thiele's " Handbuch der systematischen Weichtierkunde " (Volume II, Jena, 1935), as this is the latest and most complete classification of the Mollusca at present available.

I have to acknowledge my indebtedness to Mr. R. Winckworth who has helped us with the identification and nomenclature of many of the species referred to in this paper, to the late Mr. M. D. Crichton for his generous contributions to our shell collections, to Dr. W.J. Rees, Curator of Molluscs, British Museum (Natural History), London, and Mr. H. C. Ray of the Indian Museum, for their kind help in connection with references to literature for various species, to Dr. [illegible] H. Gravely for his guidance and advice in connection with the preparation of the manuscript of this paper and to Dr. A. Aiyappan for his encouragement and the facilities he had afforded throughout the progress of this work. I am also grateful to Messrs. P. I. Chacko, P. K. Jacob, M. Mukundan Unny and G. K. Kuryian, Research Assistants, Krusadai Marine Biological Station, for all the facilities they had given me during my collecting trips to the Island.

In preparing the illustrations for this paper, an attempt has been made to figure specimens of almost every species recorded in this account, and in the case of most lamellibranch shells, as far as possible both the inner and outer views have been figured so as to render identification comparatively easy. Some of the illustrations, particularly those of the Pteriidae, Mactridae, Donacidae, Tellinidae and the Cephalopoda, have been prepared by the author, but I should take this opportunity to express my gratitude to Miss R. Soundravally, former Assistant Curator for Natural Science in this Museum, for preparing the pencil outlines to scale for most of the drawings, to Sri S. Kanagasabai, Taxidermist in this Museum, for completing many of these illustrations with pen and ink and to Miss A. Vimala, present Assistant Curator for Natural Science in this Museum for assistance in the preparation of the index to this volume.

Class SCAPHOPODA.

The Scaphopoda are marine, bilaterally symmetrical Mollusca, with the body and shell elongated and more or less cylindrical. Their narrow, tubular shells are popularly known as "tusk shells" by reason of their striking resemblance in shape to the tusk of an elephant, the concave side being the dorsal and the convex ventral. The shell is open at both ends, the anterior end being broader than the posterior. In the living condition the foot and the cephalic tentacles known as captacula can be projected through the anterior aperture. The margins of the mantle are united ventrally. The foot is muscular, cylindrical and adapted for burrowing into sand. A radula is present. The animals live half buried in the sand at the sea bottom, with the narrow posterior extremities of the shell projecting into the water.

The family Dentaliidae, including the single genus *Dentalium*, is represented at Pamban.

Family DENTALIIDAE.

The shell is elongated, arched, smooth, or more frequently ribbed, broad in front and evenly tapering posteriorly. The foot is conical, with a laterally expanded lappet.

Genus **Dentalium** Linné, 1758.

With the characters of the family.

Four species have been recorded from Krusadai: they may be distinguished from one another as follows :—

1. Shell slender, only very slightly curved. Sculpture consisting of very fine and close-set longitudinal ribs, scarcely raised, numbering about twenty, and confined more or less to the posterior half; anterior part of shell smooth and glossy .. .. .. *D. elpis*

—Shell stouter and more strongly curved : ribs on surface of shell much stronger, more markedly raised, less numerous, more widely separated and extending throughout the length of the shell .. 2

2. Shell thick, rather stout, with eight very strong, raised, rounded, longitudinal ribs separated by wide, flattened interstices which are strongly longitudinally striated : common .. .. *D. octangulatum.*

— Shell slightly thinner and proportionately more elongated ; ribs always more than eight, generally ten or eleven ; interstices between the ribs slightly or more strongly concave, at least over a greater part of the length from the posterior end : surface of interstices smooth, or one or two of them occasionally bearing a weak, median interstitial rib ; rarer 3

3. Shell not very slender ; typically eleven-ribbed : interstices concave posteriorly, but less markedly depressed anteriorly, and almost flat at the anterior end ; ribs strong at first (i.e., posteriorly), but become weaker anteriorly, until at the anterior end they become mere angles separating plane faces : aperture polygonal in outline with straight sides ; colour creamy white when fresh .. .. *D. mannarense.*

— Shell comparatively slender, especially at the posterior part ; ribs about ten in number ; strongly developed throughout the length of the shell ; interstices more or less deep and concave throughout the length ; aperture polygonal in outline, but with concavely depressed sides ; colour pale green when fresh .. .. *D. aprinum.*

Dentalium octangulatum Donovan.

Plate I, figs. 1*a* and 1*b*.

Dentalium octangulatum, Donovan, Nat. Hist. Brit. Shells, V. 1803, pl. 162.
Dentalium octogonum, Lamarck, Anim. sans vert., V. 1818, p. 344.

Dentalium striatulum (pars), Turton, Conch. Dict. Brit. Is., 1819, p. 352, pl. xvi, figs. 5 and 6.
Dentalium octogonum, Sowerby, Thes. Conchyl., III, 1860, p. 102, pl. 223, fig. 9.
Dentalium octogonum, Sowerby, in Reeve, Conch. Icon., XVIII, 1873, *Dentalium*, pl. ii, fig. 12.
Dentalium octogonum, Angas, Proc. Zool. Soc. London, 1878, p. 868.
Dentalium octangulatum, Pilsbry & Sharp, Man. Conch., XVII, 1897, p. 16, pl. ii, figs. 16, 17, 18 and 22.
Dentalium octangulatum, Boissevain, Siboga-Expeditie, Scaphopoda, Monogr. LIV, 1906, p. 17.
Dentalium octogonum, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 151.

This is the commonest species of *Dentalium* represented at Pamban, and numerous specimens, both live ones and dead shells, have been collected. Living specimens may be obtained in fairly large numbers by dredging across Kundugal Channel and between Krusadai and Shingle Islands. The shell is rather large, moderately stout, and about 10 times as long as the diameter of the front end. It is well curved . The sculpture consists normally of eight very strong, raised, rounded, longitudinal ribs which are particularly sharp and prominent towards the narrow posterior end ; they often become slightly less strongly raised towards the anterior aperture ; they are separated by wide, fairly deep, more or less flattened or only slightly concave interstices which are traversed by numerous longitudinal striae, particularly towards the wider end ; growth lines are inconspicuous. The aperture is slightly oblique, a little longer than broad, and sharply octogonal in outline. The anal aperture is minute and slightly indented on the convex side. The shell is white, or slightly bluish white, and displays a fine gloss. The number of ribs is normally eight, but there are two abnormal specimens from Madras in the Museum collection one of which has nine, and the other only seven. In young specimens the shell is more strongly curved than in the adult, and the interstices between the ribs are smooth. Pamban, Kundugal Channel, Krusadai and Shingle Islands.

Dentalium aprinum Linné.

Plate I, figs. *2a* and **2b**.

Dentalium aprinum, Linné, Syst. Nat., Ed. XII, 1766, p. 1263.
Dentalium aprinum, Lamarck, Anim. sans vert., V, 1818, p. 343.
Dentalium striatulum, Wood, Index Test., 1818, p. 84, No. 4.
Dentalium aprinum, Sowerby, Thes. Conchyl., III, 1860, p. 102, pl. 223, figs. 5 and 6.
Dentalium aprinum, Pilsbry & Sharp, Man. Conch., XVII, 1897, p. 3, pl. i, figs. 8, 12 and 14.
Dentalium aprinum, Boissevain, Siboga-Expeditie, Scaphopoda, Monogr. LIV, 1906, p. 9.

This and the next two species are much rarer than the preceding one and represented in the collection by dead shells only. The shell is rather long, slender and well arched, especially at the posterior part. The length is about twelve times as much as the maximum diameter. The sculpture consists of about ten narrow and sharply raised longitudinal ribs, separated by much wider, rather deeply concave interstices which are frequently divided by a fine median riblet. The ribs are stronger on the concave side of the shell. Growth striae are inconspicuous as in the preceding species. The aperture is polygonal in outline, the

sides of the polygon, however, being concavely depressed. The anal aperture is minute, circular, and not indented. The two shells in the collection measure only about 25 mm. in length but specimens have been known to attain a length of even 70 mm. Both the shells are bleached white, but when fresh, the shell is banded with pale green. Pamban.

Dentalium mannarense Winckworth.

Plate I, figs. 3*a* and 3*b*.

Dentalium mannarense, Winckworth, Proc. Malacol. Soc. London, XVII, 1927, p. 167, pl. xiv, figs. 1 and 2 and text fig. 1.

A single dead shell of this species is represented in the collection, but Mr. Winckworth reports that he had also collected live specimens of this as well as the next species while dredging off Manaar. The shell is not very slender, but moderately curved and becomes almost straight anteriorly. The shell is typically eleven-ribbed, though Mr. Winckworth records specimens with nine, ten, twelve and even thirteen ribs. The ribs are strong towards the posterior end, with wide, slightly concave spaces between, over the greater part of the shell, but they become less markedly raised towards the anterior end where they are little more than angles between plane faces, making the aperture circularly polygonal. In one or two of the interspaces, a median interstitial rib is developed. The entire surface is covered by fine, longitudinal, microscopic striae, both on the ribs and in the interstices. Fine growth lines may also be seen on the smoother anterior part. Mr. Winckworth makes mention of a small, delicate, posterior, tubular prolongation with a notched aperture, but this is missing in the present specimen. The shell measures 42 mm. long and 4 mm. wide at the anterior aperture. The shell is pale creamy white, tinged with bluish white near the anterior end where the shell is somewhat thin. Gulf of Manaar.

Dentalium elpis Winckworth.

Plate I, figs. 4*a* and 4*b*.

Dentalium elpis, Winckworth, Proc. Malacol. Soc. London, XVII, 1927, p. 168, pl. xiv, figs. 6 and 7.

A single shell is represented in the collection. The shell is narrow, markedly slender, not much widened anteriorly and only very slightly arched. The shell is readily distinguished from those of the preceding species by its peculiar sculpture. The surface is very finely and closely ribbed over a little more than half the length from the posterior end, while anteriorly the shell is quite smooth. The ribs are very slightly raised and terminate about half way along the concave (dorsal) side and extend a little further along the ventral side. There are also fine, evenly developed growth lines which are visible under the lens, on the smooth, glossy, anterior part of the shell. The shell is pale bluish white for the most

part, but the posterior tip is more or less pure white. Mr. Winckworth quotes a detailed description of the radula of this species by Dr. Bowel, in his paper cited above. The single shell in the collection measures 24 mm. long and 2 mm. wide at the anterior aperture. Gulf of Manaar.

Though specimens of Dentaliidae are generally best represented in dredge collections, it is not uncommon to find dead shells, especially of *Dentalium octangulatum*, frequently washed up on the beach on Krusadai and Shingle Islands.

Class PELECYPODA (= BIVALVIA).

This class, also known as the Lamellibranchiata, constitutes another large and important group of shell-bearing Molluscs, comprising a wide variety of forms such as the scallops, mussels, oysters, clams, cockles, wedge shells, feather shells, paper shells and their allies. In this group, the shell is bivalve, that is to say, it is made up of two valves—the right and left—which are firmly hinged together at their apex, known as the umbo. The hinge consists of a set of interlocking teeth supplemented by a horny ligament. The mantle is also made up of two lobes—the right and left—and encloses the pallial cavity in which the lamelliform gills are placed. The foot is generally laterally compressed, and more or less wedge-shaped, and in many Lamellibranchs, it enables the animal to burrow rapidly in sand or mud. For a description of the hinge teeth, muscles, impressions on the shell and habits of the bivalves, reference may be made to "Shells and Other Animal Remains found on the Madras Beach" by Dr. F. H. Gravely, pages 26—31 (*Bulletin of the Madras Government Museum, New Series, Natural History Section*, V, No. 1, 1941).

The classification adopted in this paper is in the main that followed by Thiele in his "Handbuch der systematischen Weichtierkunde" (1931), this being the latest and most complete system now available. Thiele divides the Lamellibranchiata into three orders, the characters of which are briefly outlined below :—

1. TAXODONTA.—The hinge margin bears more or less numerous, undifferentiated and uniformly developed teeth. Two adductor muscles are almost always present.

2. ANISOMYARIA.—The anterior adductor muscle is reduced or more or less completely suppressed. Real hinge teeth are scarcely present, but sometimes small tubercles or distinct tooth-shaped processes are developed. The embryonic shell bears a striated hinge margin. The mantle is open, without siphons. The gill lamellae are either smooth, with evenly developed filaments, or plaited with unequal filaments.

3. EULAMELLIBRANCHIATA.—The mantle often bears posterior siphons. The anterior adductor muscle is seldom reduced or suppressed. The hinge teeth are usually few in number, and those of the two valves closely interlock with each other. A right central tooth and lateral teeth are also often present. The gill filaments as a rule form two plaited lamellae which are always connected together by vascular junctions.

Pelseneer's classification (adopted in his volume on Mollusca in the Series of Lankester's Treatise on Zoology) differs slightly from the above, and is based mostly on the characters of the gill, but as it is sound enough for practical purposes and is still followed by many authors, it may be helpful to point out the chief diagnostic characters of Pelseneer's orders also :—

1. PROTOBRANCHIA.—The gill consists of simple and flat filaments which are not reflected on themselves and which are disposed in two rows on opposite sides of the gill axis.

2. FILIBRANCHIA.—The gills are formed of parallel, ventrally directed and reflected filaments. Successive filaments are jointed together by cilia.

3. EULAMELLIBRANCHIA.—The branchial filaments in the gills are united at regular intervals by vascular junctions which transform the linear inter-filamentar spaces into a series of openings. Similarly the adjacent lamellae of each gill are connected at intervals by inter-lamellar vascular junctions. But this order does not correspond exactly to the Eulamellibranchiata of Thiele.

4. SEPTIBRANCHIA.—The gills are transformed into a muscular septum which extends from the anterior adductor to a point between the two siphons. The septum is always perforated by paired openings which admit passage of water.

As with the Gastropods in the previous volume of this paper, it has been thought desirable to draw up a diagnosis for the Pelecypoda also, based mainly on easily recognizable characters of the shell so as to enable the collector to place the shells he collects in their respective families. It is therefore hoped that the following key, which again is based largely on the one drawn up by Dr. Gravely for Madras bivalves will be found helpful in separating the various families of Lamellibranchs represented at Krusadai:—

1. Hinge with more or less numerous, simple, undifferentiated linear teeth, either parallel to one another, or diverging from below upwards. Two muscle impressions almost always present ..	2 (TAXODONTA).
— Real hinge teeth either scarcely developed, or hinge bearing a few teeth, generally much stronger, of which the central ones (i.e., the cardinal teeth) diverge from the umbo downwards. Two muscle impressions often present, but sometimes the anterior adductor impression is either reduced or altogether absent	5 (ANISOMYARIA AND EULAMELLIBRANCHIATA).

2. Shell very small and rather thin, with an angular dorsal border. Surface of shell usually finely concentrically ridged. Mantle borders generally produced posteriorly	NUCULANIDAE, p. 16. (=LEDIDAE).
— Shell larger, thicker and stony, with the dorsal border either straight or obtusely rounded; sculpture usually stronger and more varied, often including radiating ribs. Mantle borders not produced posteriorly	3
3 Hinge straight, and shell generally more elongated transversely. Valves considerably deeper ..	ARCIDAE, p 17.
— Hinge markedly curved, and shell generally shorter transverely, and more evenly rounded. Valves rather shallow	4
4 Shell more or less regularly rounded in outline. Surface of shell without hairy epidermis. Ligament with oblique thickenings, external. Foot large and without a byssus	GLYCIMERIDAE, p. 27.
— Shell sub-orbicular, with the transverse axis longer than the longitudinal; surface of shell often covered with a hairy epidermis. Ligament simple, more or less sunk inwards. Foot smaller and bears a byssus	LIMOPSIDAE, p 28.
5. Anterior adductor muscle and its impression usually much reduced or more or less completely absent. True hinge teeth are scarcely-developed, but sometimes small tubercles or tooth-like processes developed instead. Mantle open, without siphons	6 (ANISOMYARIA).
— Anterior adductor muscle and its impression seldom reduced or suppressed. True hinge teeth usually present, these being few in number, and those of the two valves closely interlocking with each other. Mantle often with posterior siphons	14 (EULAMELLIBRANCHIATA).
6. Ligament simple, without nodules. Umbo generally placed at or very near the front end. Shell generally tending to be elongated or produced antero-posteriorly	7

— Ligament with one or more internal nodules. Umbo generally placed more centrally. Shell tending to be less elongated and more rounded or irregular, or more produced dorso-ventrally .. 9

7. Anterior adductor almost always present. Ligament almost always external .. .. .. MYTILIDAE, p. 29.

— Anterior adductor absent. Ligament usually more or less sunk 8

8. Shell large, thin and elongately triangular in outline, with the umbo situated at the pointed front end. Hinge margin entirely *toothless*. Ligament situated in a groove .. .. PINNIDAE, p. 53.

—Shell smaller and thicker and not strictly elongately triangular as above; posterior angle often markedly produced. Hinge margin elongated, its hind end being angular or elongated, and bearing one or two tooth-like thickenings. Ligament somewhat sunk .. .. PTERIIDAE, p. 48.

9. Shell more or less irregular, usually very thick, surface rather coarse, not regularly radiately ribbed though sometimes bearing radial rows of roughened processes or thrown into broad radial folds. Shell inequivalve, attached by one of the valves, the attached valve being generally larger and deeper ... 10

— Shell generally more regular and more or less evenly rounded, thinner, but when thick and irregular, valves greatly dorso-ventrally produced. Shell generally equivalve, and not attached by either of the valves. Sometimes a byssus is present .. 11

10. Shell whitish, with greyish or blackish markings and blotches, attached by the left valve; surface roughly concentrically wrinkled or thrown into radial folds. Hinge toothless, with a more or less distinct triangular groove for the ligament nodule. Pair of large teeth never present .. .. .. OSTREIDAE, p. 66.

— Shell pinkish, attached by the right valve, surface beset with radial rows of processes. Hinge margin straight and slightly extended laterally, and with a pair of large teeth, one on each side of the ligament nodule .. .. PECTINIDAE, p. 57. (Part; Sub-family SPONDYLINAE), p. 62.

11. Shell regular, equivalve, of a pinkish or mottled colouration, and as a rule strongly and closely radiately ribbed. Shell never with a byssus. Umbo as a rule projecting beyond the hinge margin. 12

— Shell slightly or more markedly irregular, generally inequivalve, usually whitish or pale brownish in colouration, not radially ribbed, though feebly or coarsely concentrically striated. Shell mostly with a byssus, either throughout life or in the early stages only. Umbo not projecting beyond the hinge margin 13

12. Hinge margin straight and frequently rather elongated, being produced on either side into a pair of processes called the auricles, below which the shell usually has an almost perfectly circular outline, being as broad as high. Colour usually pinkish or variously mottled .. .. .. PECTINIDAE, p. 57 (Part: Sub-family PECTININAE), p. 58.

— Hinge margin, though straight, very short and without well defined auricles and somewhat projecting upwards in the middle. Outline of shell characteristically elongately ovate, the valves being definitely higher than long. Shell usually colourless .. .. LIMIDAE, p. 64.

13. Shell rounded, only slightly irregular, thin, and inclined to be translucent and more or less iridescent. Hinge margin more or less rounded or bluntly angular. Byssus, when present, generally disappearing in the adult .. .. ANOMIIDAE, p. 65.

— Shell generally more elongate dorso-ventrally, and more irregular in outline, thick and opaque,

iridescence, when present, being noticeable only on the inner surface. Hinge margin straight, and sometimes produced strongly into long processes on each side (except in *Vulsella*). Byssus, when present, persists in the adult .. .. .. **ISOGNOMONIDAE, p. 42.** (=**VULSELLIDAE**).

14. Shell very irregular and very thick, often crudely beset with elongated lamellae or spinuous processes. Hinge margin thick, and its teeth very stout. Shell attached by one valve, generally the left .. .. **CHAMIDAE, p. 84.**

—Shell not as above, generally thinner, less irregular, and with thinner hinge teeth. Shell not attached by either of the valves 15

15. Shell with valves equal (equivalve) or very nearly so, more or less triangular, rounded or ovate, almost always with from one to three cardinal teeth immediately below the umbo and often with anterior and posterior lateral teeth (Heterodonta). **16**

— Shell more variable in form, usually thin, sometimes strongly inequivalve or greatly reduced when it is not infrequently supplemented by an elongated calcareous tube, much larger than itself. With or without cardinal teeth, and always without lateral teeth (Adapedonta and Anomalodesmata). 28

16. Shell small, thin, fragile, and rather widely gaping. Mantle more or less completely reflected over the shell. Bivalves possessing the power of swimming. **ERYCINIDAE, p. 81.** (=**GALEOMMIDAE**).

—Shell generally larger, thicker and stronger, valves completely closed or only narrowly gaping. Mantle not reflected over the surface of the shell. Bivalves without the power of swimming, and either sedentary, slow-moving or burrowing 17

17. Shell circular in outline, more or less convex and moderately or often greatly inflated, usually thin. Umbo very small and hinge teeth often rudimentary or absent. Ligament more or less internal and linear, and not bearing any compact, rounded nodule .. .. **LUCINIDAE, p. 74.**

— Shell generally not strictly circular, more variable in outline, being more transversely elongate, triangular or ovate, usually less convex and less markedly inflated and thicker. Umbo larger and hinge teeth generally more perfectly developed. Ligament either with or without a nodule 18

18. Shell very large, thick and massive, often weighing several pounds. Shell roughly elongately triangular in outline. Valves thrown into a few, very deep and broadly rounded radial folds the edges of which on the two valves interlock tightly with each other when the shell is closed. Surface bearing scaly, concentric ridges. Giant Clams with a strong byssus .. .. TRIDACNIDAE, p. 97.

— Shell not as above, comparatively much smaller and thinner and less massive, and valves not thrown into broad, radial folds, though regular, narrow ribs may be developed. Byssus usually rudimentary or wanting altogether 19

19. Ligament without internal nodule, and hence hinge plate normally developed without any rounded socket for the reception of the ligament nodule. 20

— Ligament with internal nodule and hinge bearing a more or less triangular or rounded cavity just behind the cardinal teeth for the reception of this nodule 25

20. Shell smooth, or, when sculptured, as a rule bearing concentric striae or ridges or, when radial ridges are present they are almost always supplemented by concentric grooves or ridges or frilled lamellae. A well-developed lunule (flattened area behind the umbo) generally present 22

— Shell almost always sculptured exclusively with strong radial ribs which are either narrow, strongly raised (and sometimes even keeled), and separated by deeply excavated interstices, or broad and flattened, separated by narrower and shallower interstices. A well defined lunule absent .. 21

21. Shell more or less strongly inequilateral, with the umbo placed well in front of the middle and sometimes in a line with the anterior margin. Anterior cardinal teeth mostly reduced; posterior two on the right valve and one on the left very long and oblique. Lateral teeth usually rudimentary .. CARDITIDAE, p. 71.

— Shell usually more or less perfectly equilateral, and rounded in outline. Teeth alike on the two valves. Both anterior and posterior laterals well developed and widely separated from the cardinals .. .. CARDIIDAE, p. 89.

22. Shell more or less strongly transversely elongated (Genus *Petricola*, which alone is represented at Krusadai). Shell often small and colourless. Hinge margin without lateral teeth. Shell usually partially sculptured with oblique radial ribs .. PETRICOLIDAE, p. 134.

— Shell not as above 23

23. Shell regular, generally with an evenly rounded outline, somewhat convex, usually thick. Valves always completely closing. Shell often with a well defined lunule. Sculpture very variable, ranging from fine concentric striae to strong, raised, concentrically crested lamellae, and sometimes radial ribs present in addition. Pallial sinus usually present, but generally more or less shallow .. VENERIDAE, p. 98.

— Shell less regularly rounded in outline, sometimes triangular, or sometimes more varied. Valves less deeply convex. Shell generally thinner, sometimes gaping. Sculpture as a rule weak, and at most consisting of concentric striae or ridges only. Pallial sinus deep, often more or less fully coalescing with the lower part of the pallial line 24

24. Shell more or less definitely triangular in outline, with the umbo placed well behind the middle. Shell often bearing a well defined oblique keel or angulation running from the umbo to the hind lower angle of the shell .. .. DONACIDAE, p. 143.

— Shell not (or less definitely) triangular in outline, of varied shape, often somewhat thinner, and sometimes with a broad, shallow, radial depression about the middle. Valves more or less flattened, particularly when the shell is much longer than high .. **Tellinidae**, p. 153.

25 Pallial sinus absent. Shell usually longer than broad, and the hind border generally somewhat beak-shaped, and surface of shell often strongly concentrically furrowed .. .. **Crassatellidae**, p. 70.

— Pallial sinus present. Shell mostly triangularly ovate, or rounded, generally not markedly longer than broad. Hind margin of shell, though sometimes narrowed, never pointed and beak-like. Surface of shell generally smooth or at most faintly concentrically striated 26

26. Shell usually thick, compressed, triangular, inequilateral, with the umbo placed behind the middle, the front dorsal margin being larger than the hind dorsal margin. Surface of shell often covered with a distinct yellowish brown periostracum. Pallial sinus generally angular behind .. **Mesodesmatidae**, p. 135.

— Shell somewhat thinner and more inflated, triangularly ovate or rounded, more or less equilateral. Surface of shell without conspicuous periostracum. Pallial sinus rounded behind, though sometimes narrowed 27

27. Pallial sinus broadly open behind. Shell mostly triangularly ovate in outline. Socket for ligament nodule rounded and more or less centrally situated **Mactridae**, p. 137.

— Pallial sinus narrowed behind. Shell mostly rounded or oval in outline. Socket for ligament nodule somewhat elongated and oblique, extending backwards and downwards just behind the cardinal teeth .. .. **Semelidae**, p. 150.

28. Shell minute and inconspicuous and embedded in a well developed, elongated, calcareous tube, very much larger than the shell itself, the broader end of the tube being closed by a perforated disc .. **Clavagellidae**, p. 173.

— Shell not as above, comparatively much larger, valves more or less normally developed, though mostly thin. Shell almost always without the large, accessory calcareous tube characteristic of the above. Either free-living or boring forms .. 29

29. Valves normally developed and hinged together in the normal manner. Not burrowing in hard material such as wood or coral rock 30

— Valves often reduced and mostly hinged together by muscles only, but sometimes by a ligament in addition. Shell boring into hard material such as wood or coral rock 32

30. Valves more or less elongated and oblong, or, very often almost perfectly straight-edged and rectangular in outline. Shell with rounded or more often truncated anterior and posterior extremities. Shell equivalve, gaping at both ends, and often brightly coloured .. .. SOLENIDAE, p. 157.

— Shell markedly inequivalve, not greatly elongated as above. Valves generally with the hind extremity more narrowly rounded than the front, and either completely closing or gaping only at the hind end. Shell often whitish 31

31. Hinge formed by a process of one valve passing under the dorsal margin of the other with the ligament in between. Inner surface of shell not pearly. Shell closing completely, usually small, but more or less thick, often with concentric sculpture .. .. ALOIDIDAE, p.160. (=CORBULIDAE).

— Hinge not formed as above. Inner surface of shell more or less pearly. Shell mostly gaping behind, usually larger, thinner and more fragile. Surface smooth or only finely striated. Umbo divided into front and hind parts .. .. .. LATERNULIDAE, p. 172.

32	Ligament present, shell more or less small, and always protected within a burrow in coral rock or molluscan shells[1]	GASTROCHAENIDAE, p. 161. (=ROCELLARIIDAE).
—	Ligament absent, valves well developed and often bearing accessory calcareous plates. Shell of variable shape, either globular, or elongate, sometimes greatly so	PHOLADIDAE, p. 166.

Order Taxodonta.

SERIES NUCULACEA.

Family NUCULANIDAE (= LEDIDAE.)

The shell is small and not pearly. The hinge has numerous minute teeth. The upper border of the shell is angular. The mantle is united at two places posteriorly and there are two siphons. The gills are in the form of simple filaments, not united to form definite lamellae.

This family is represented at Krusadai by a single species belonging to the genus *Nuculana*.

Genus **Nuculana** Link, 1807.

(Syn. **Leda** Schumacher, 1817).

The shell bears a more or less elongated, sometimes pointed, sometimes truncated beak posteriorly and as a rule concentrically sculptured. The ligament nodule is short and situated beneath the umbo.

Nuculana mauritiana (Sowerby).

Plate **II**, figs. 1*a* and 1*b*.

Nucula mauritiana, Sowerby, Conch. Illustrations, 1833, *Nucula*, p. 4, No. 22, fig. 17.

Nucula mauritiana, Hanley, Cat. Recent Bivalve Shells, 1843, p. 170, pl. 19, fig. 46.

Leda mauritiana, Sowerby, Thes. Conchyl., III, 1862 (Hanley, Monograph of the family Nuculidae), p. 126, No. 38, fig. 99.

Laeda mauritiana, Sowerby, in Reeve, Conch. Icon., XVIII, 1871, *Laeda*, pl. vi, fig. 33.

Nuculana mauritiana, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 105.

Nuculana mauritiana, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 32, fig. 14*b*.

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[1] In the genus *Cucurbitula*, however, which is represented at Madras, but not at Pamban, the shell is protected by a calcareous tube embedded in sand.

This species, which is also recorded from the Madras beach, is represented in the Museum collection by a number of dead shells from Pamban. The shell is small, whitish and bears a slight gloss over the surface. The valves are rather transversely elongated, with the front border rounded and the posterior margin produced into a more or less well developed, pointed and slightly upwardly curved beak behind. The surface is traversed by fine, close-set, concentric grooves. The umbo is bluntly angular and the area behind the umbo is strongly depressed, and this area in the two valves together forms a well defined elongately ovate, flattened space. The hinge bears numerous small, simple, parallel and undifferentiated teeth which are somewhat oblique and diverge away from the umbo. These teeth are very much reduced and almost entirely absent from the region immediately beneath the umbo. The anterior portion of the shell presents a rather strongly inflated appearance. The pallial line is entire and angular behind. The shell is small, the largest specimen in the collection measuring only about 8 mm. in length and 4 mm. in maximum height. The shell is whitish throughout, and the interior is not pearly. Pamban.

SERIES ARCACEA.

Family ARCIDAE.

The shell is almost always radially ribbed and bears a strongly raised umbo. When fresh the shells are often covered by a blackish or dark brown periostracum which may be frequently hairy. The hinge is straight, or very nearly so, with numerous, simple, linear teeth (pliodont). The] foot bears a simple byssus. The animal is filibranch, i.e., with gills made up of folded filaments connected by tufts of cilia.

This family includes a single genus, *Arca*, comprising the ark shells.

Genus **Arca** Linné, 1758.

With the characters of the family.

Nine species of *Arca* have been recorded from the Pamban area, and of these, all, except *A. plicata* and *A. fusca*, are represented in the Madras area also. The Krusadai species of *Arca* may be distinguished with the aid of the following key :—

1. Shell markedly twisted, and with a more or less irregular outline. Valves with an oblique keel running from the umbo down to the lower margin.	*A. tortuosa.*
— Shell not twisted as in the above, and with a more or less regular outline, and without a strong oblique keel. Opposite valves more or less similar to each other	2

2. Anterior and posterior extremities of upper margin of shell more or less rounded. Sculpture consisting of fine radiating ribs 3

— Anterior and posterior extremities of upper margin of shell more or less sharply angular. Sculpture consisting of stouter and stronger radial ribs .. 4

3. Shell with the front margin distinctly narrower than the hind one. A distinct and characteristic double scar present on the interior of the shell running from the umbo to the top of the hind margin of the shell. Shell whitish .. .. .. *A. lateralis.*

— Shell with front and hind margins approximately equal in breadth. Without characteristic double scar as in the above. Shell dark reddish brown, with three broad, white bands radiating from the umbo .. .. *A. fusca.*

4. Shell with a distinct keel towards the hind border, extending from the umbo to the lower margin. Umbones rather strongly raised and more or less sharply curved inwards 5

— No such keel present, the hind part of the valves being more or less evenly rounded. Shell moderately large. Umbones relatively less strongly raised, and more or less normally developed .. 7

5. Surface of shell sculptured with strong, raised, lamella-like concentric ribs which are cut up into rows of nodules by relatively weak radial grooves. Interstices separating the concentric ribs very deeply incised. Area behind the keel sculptured with stout concentric ribs which divaricate strongly away from the keel. Area of the ligament narrow, linear .. .. *A. plicata.*

— Sculpture weaker and finer, and as a rule radial sculpture predominating over the concentric, the latter being usually reduced to faint grooves or striae. Area behind the keel sculptured with radial ribs more or less parallel to the keel in direction. Area of the ligament more strongly depressed and more or less definitely rhombus-shaped 6

6. Shell moderately large. Shape of shell rather irregular. Ligamentary area somewhat large and sloping steeply inwards. Hind margin oblique and forming an obtuse, but sharply defined angle with the hind portion of the upper border which is somewhat slanting. Area of ligament rather extensive and deeply concave .. .. .. *A. avellana.*

— Shell very small, solid, and more regular in shape. Ligamentary area narrower and umbones approaching nearer each other. Front margin more evenly rounded. Radial ribs fine and regularly developed, and often traversed by two or three sets of transverse grooves. Area of ligament small. *A. symmetrica.*

7. Shell very large and thick, solid and heavy. Valves deep and rather strongly inflated. Ribs broad and flattened. Ribs on front part of the shell double. Hinge area broad .. .. .. *A. gubernaculum.*

— Shell slightly smaller and thinner, lighter and less massive. Valves shallower and less markedly inflated. Ribs either very narrow, numerous and close-set, or broader, flattened, less numerous and more widely separated. Hinge area narrower .. 8

8. Shell rather variable in shape, but definitely more than one and a half times as long as high, ribs numerous, close-set and sometimes converted into radial rows of granules by parallel, concentric grooves. Stiff, blackish brown bristle-like hairs on the horny periostracum more persistant than in the other species .. .. *A. complanata.*

— Shell more constant in shape, not much longer than high, deeper, ribs flattened and smooth. Transverse grooves or ridges absent. Horny covering on surface of shell rarely persistent. Front margin broadly rounded. Hind margin straight, broader than the front .. .. .. *A. inaequivalvis.*

Of the nine species of *Arca* enumerated above, specimens of *A. complanata*, *A. symmetrica* and *A. avellana* are usually found alive attached to pieces of dead coral and shingle on

the Galaxea and Pulli Reefs and on the reefs adjoining Shingle Island. *A. complanata* is also particularly common on the large blocks of stone beneath the Pamban bridge where they are often found along with living specimens of *Euchelus asper* and *Gyrineum natator*, and attain a considerably large size. *A. lateralis* and *A. plicata* are also occasionally found alive in similar situations, but are much rarer. The remaining species are generally represented only by empty valves washed up on the beach, and of these *A. inaequivalvis* and *A. fusca* are by far the commonest, the former occurring in plenty on the shore line at Kundugal Point and the latter mostly on the beaches on Krusadai and Shingle Islands, particularly on the latter. Dead shells of *A. inaequivalvis* also occur on Krusadai Island, where, however, they are less common than at Kundugal Point.

Arca avellana Lamarck.

Plate II, figs. 2*a* to *c*.

Arca avellana, Lamarck, Anim, sans vert., Ed. 2, VI, 1819, pp. 38 and 39.
Arca tetragona, Audouin (nec Poli, non Lamarck), Expl. Descr. Egypte, XXII, 1827, p. 203.
Byssoarca maculata, Sowerby, Proc. Zool. Soc. London, 1833, p. 17.
Arca imbricata, *A. maculata*, *A. cunealis* and *A. volucris*, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xi, figs. 71 and 73; pl. xiii, fig. 87 and pl. xvi, fig. 109.
Arca imbricata, Melvill & Standen, Journ. de Conchyl., IX, 1898, p. 81.
Arca Kraussi, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 14.
Arca (*Navicula*) *avellana*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 32.

This species has been known by different names by various authors, but Lamarck's name, *avellana*, has priority over the rest. The record of *A. navicularis* in the previous list of Krusadai Mollusca [*Bull. Mad. Govt. Mus.*, (*Nat. Hist.*), I, No. 1, 1927, p. 104] is obviously based on wrong identification, as all the supposed specimens of *A. navicularis* that were later sent to Mr. Winckworth have been correctly renamed by him as *A. avellana*. The shell is subject to considerable variation in the shape of its outline and the depth of the valves, and this is partly responsible for the variety of names under which this species has been described by various authors. The shell is moderate-sized, with rather strongly inflated valves, and an oblong, or occasionally slightly irregular outline, the ventral margin being usually feebly concave posteriorly. The anterior margin is rounded while the posterior is straight and obliquely truncated. The umbo is strongly raised above the hinge line, and markedly curved inwards. There is a strong, oblique, angular keel running on the posterior part of the valves, from the umbo to the hind lower angle. The surface of the shell is traversed by fine, close-set, radiating ribs, crossed by concentric grooves. The sculpture is stronger and coarser in the concavely depressed area of the surface posterior to the keel. The ligamentary area is broad, concave and rhomboidal. The hinge teeth are very fine. The posterior margin of the valves presents a toothed appearance interiorly owing to the presence of the strong external ribs. The shell is whitish with indistinct brownish markings,

In many specimens, remnants of a dirty greyish brown periostracum still persist. This species is moderately common in the Pamban area, whence both dead shells and living specimens have been collected. Young shells are proportionately more elongate than adult ones. Rameswaram, Pamban, Krusadai and Shingle Islands.

Arca fusca Bruguière.

Plate II, figs. 3*a* and 3*b*.

Arca fusca, Bruguière, Encyclopédie Méthodique, Vers, I, 1789, p. 102, pl. 308, fig. 5.
Arca fusca, Lamarck, Anim. sans vert., Ed. 2, VI, 1819, p. 39.
Arca fusca, Sowerby, Cat. Tankerville, 1825, p. 18.
Arca fusca, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xii, fig. 82.
Arca (*Barbatia*) *fusca*, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 260.
Arca (*Barbatia*) *fusca*, Lamy, Journ. de Conchyl., LV, 1907, p. 53.
Arca (*Barbatia*) *fusca*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 15.
Arca (*Barbatia*) *fusca*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 45.

This species is well represented, but only by empty valves, which are particularly common on the beach on Shingle Island. The Pamban shells are all only of moderate size, attaining at most a length of a little less than an inch and a half, but shells collected at Tuticorin attain a much greater size, some of the larger ones measuring fully over two inches in length. The shell is thick, considerably elongated and with a fairly regular margin which is evenly rounded in front and behind, but very inequilateral, the umbo being situated very close to the anterior margin. The ventral margin is almost perfectly straight, but occasionally bears a very broad, slight, concave indentation. The anterior and posterior margins of the hinge are bluntly rounded instead of being pointed and angular as in the preceding species. The surface of the shell bears a somewhat fine sculpture, consisting of fine, close-set, radiating ribs, of which stronger and broader ones generally alternate with narrower and weaker ones. Towards the anterior and posterior extremities the stronger radial ribs are more pronounced and more widely separated, there being sometimes more than one of the weaker ridges in each of the interstices in these regions. The entire surface is also traversed by fine, concentric grooves which decussate with the radial ribs, more or less converting the latter (particularly the stronger ones) into radial rows of rounded granules. These granules are larger and stouter in the posterior region of the surface. The umbo is only slightly raised above the hinge. The ligamentary area is very narrow, elongated and slopes steeply inwards. It is strongly transversely striated. Strong concentric growth striae at regular intervals are conspicuous in many shells. The shell is of a deep chestnut brown colour, with three broad white bands, widely radiating from the umbo, of which the posteriormost is the longest. In young shells these rays are so disproportionately large that the brown-coloured part of the surface is reduced to small, triangular segments. Pamban, Krusadai and Shingle Islands.

Arca complanata Chemnitz.

Plate II, figs. 4*a* and 4*b*.

Arca complanata, Chemnitz, Conchyl. Cab., VII, 1784, p. 198, pl. 55, figs. 544 and 545.
Arca complanata, L. Morlet, Journ. de Conchyl., XXXVII, 1889, p. 162.
Arca (*Barbatia*) *complanata*, Chemnitz, Fischer, P., Cat. de Moll. de l' Indo-Chine, 1891, p. 215.
Byssoarca velata, Sowerby, Proc. Zool. Soc. London, I, 1833, p. 18.
Arca velata, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xii, fig. 79.
Barbatia velata, Dunker, Novitates Conchologicae, 1868, p. 124, pl. 41.
Arca (*Barbatia*) *complanata* (pars), Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 15.
Arca complanata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 33.

Lynge has combined *A. velata* and *A. decussata* into a single species, and treats it as a synonym of *A. complanata*, but Prashad observes that *A. decussata* is distinct and it is only *A. velata* which is synonymous with the present species. Specimens of this species are often found alive in fairly large numbers attached to coral rocks and blocks of stone, particularly beneath the Pamban bridge. The shell is almost always covered by a very thick, blackish brown periostracum which bears stiff, bristle-like hairs which are strongest and most densely developed towards the ventral and posterior portions of the surface. The shell is oblong, being always longer than high, but the outline of the margin is subject to a certain degree of variation. The hind upper margin slopes obliquely backwards and merges into the posterior margin, which is sometimes truncated, and sometimes rounded. The posterior side is as a rule slightly broader than the anterior, but not markedly so. The ventral margin is feebly indented in the middle and slightly gaping. The umbones are moderately raised and the ligamentary area is narrow, depressed and elongately elliptical. The sculpture consists of numerous, fine, close-set, radiating ribs which are closely decussated by faint, concentric grooves, rendering the ribs somewhat granular, but the radial sculpture predominates. The outer surface is whitish, with dirty or rusty brown markings. The interior of the shell is smooth, rather glossy, whitish, and very slightly tinged with pale blue towards the edge. In living specimens the surface of the shell is often covered with weedy or limy encrustations in addition to the stiff bristles of the periostracum. This species is represented in the collection both by dead shells and spirit specimens with the soft parts intact. Pamban and Krusadai Island.

Arca symmetrica Reeve.

Plate II, figs. 5*a* and 5*b*.

Arca symmetrica, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xvii, fig. 120.
Arca symmetrica, Reeve, Proc. Zool. Soc. London, 1844, p. 127.
Arca (*Barbatia*) *symmetrica*, Smith, Rep. Voy. " Albert," 1884, p. 111.
Arca symmetrica, von Martens, Journ. Linn. Soc. London (Zoology), XXI, 1886, p. 207.
Barbatia symmetrica, Paetel, Cat. Conch. Samm., III, 1890, p. 214.
Arca symmetrica, Lamy, Journ. de Conchyl., LV, 1907, p. 104.
Arca (*Fossularca*) *symmetrica*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 54.
Arca symmetrica, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 34.

Of all the species of *Arca* recorded from Pamban, the present one possesses the smallest shell. Specimens of this species are usually found alive in moderately large numbers, sticking to blocks of dead coral rock on the reefs, either on the surface or inside crevices. The shell is very small, barely about a centimeter in length, often smaller, and a little more than half as high, comparatively thick, compact and regular, with the valves closing completely. The ends of the upper margin are sharply angulated, the anterior margin rounded, the posterior obliquely truncated, and the ventral margin almost straight and parallel to the upper margin. The valves bear a moderately well defined, oblique keel running posteriorly from the umbo to the hind lower angle. The umbones are raised, inwardly curved, those of the two valves being rather closely approximated towards each other. Though the ligamentary area is fairly large and broadly ovate, the ligament itself is very small and occupies only a small, rhomboidal space beneath the umbones. The surface bears a well marked sculpture consisting of fine, radiating ribs crossed by concentric striae. The radial ribs in the region posterior to the keel are much stouter and more pronounced than those on the rest of the surface. The shell is uniformly whitish both externally and internally. Pamban and Krusadai Island.

Arca lateralis Reeve.

Plate II, figs. 6*a* and 6*b*.

Arca lateralis, Reeve, Proc. Zool. Soc. London, 1844, p. 127.
Arca lateralis, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xvii, fig. 115 (figure not good).
Arca lateralis, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 33.

This species is rare at Pamban and represented in the collection by a single shell with both the valves intact. The shell is moderate-sized, not very thick, longer than high and strongly inequivalve with the umbo placed far forwards. The straight dorsal hinge margin is rather short and its ends are not very sharply angulated. Posteriorly, the straight dorsal margin is somewhat short and soon merges into the very broadly rounded posterior margin which is markedly more widely expanded than the narrowly rounded anterior margin. The ventral margin is slightly irregular and narrowly gaping when the valves are closed. The valves are rather strongly and obliquely inflated, roughly along a line extending from the umbo downwards and backwards, but there is no well defined keel as in *A. avellana* or *A. symmetrica*. The umbones are raised and curved inwards, and the ligamentary area is elongately lanceolate. The outer surface of the shell is sculptured with strong radiating ribs which are finely transversely grooved. In the central region of the surface there is generally a much finer and narrower radial rib running in each of the interstices between the main ribs, so that the ribs in this part are alternately stout and thin. The shell is whitish, covered with a thick, blackish brown periostracum, bearing short, stiff, scaly processes, remnants of which persist towards the margins, particularly towards the

posterior margin, in the present specimen. The inner surface of the valves is yellowish white and bears a distinct, long, double scar extending from the umbo to the upper part of the hind margin. This feature is very characteristic of the present species. Krusadai Island.

Arca plicata Chemnitz.

Arca plicata, Chemnitz, Conchyl. Cab., XI, 1795, p. 244, pl. 204, fig. 2008.
Byssoarca divaricata, Sowerby, Proc. Zool. Soc. London, I, 1833, p. 18.
Arca gradata, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xiv, fig. 92.
Arca divaricata, Reeve, ibid., pl. xvi, fig. 108.
Barbatia (*Acar*) *laminata*, Angus, Proc. Zool. Soc. London, 1865, pp. 697 and 655.
Barbatia squamosa, Pritchard & Gatliff, Proc. Roy. Soc. Victoria, XVII, pt. 1, 1904, p. 241.
Arca (*Acar*) *gradata* (nec Broderip & Sowerby) Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 797.
Arca (*Acar*) *plicata*, Lamy, Journ. de Conchyl., LV, 1907, p. 80.
Arca (*Acar*) *plicata*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 20.
Arca (*Acar*) *plicata*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 50.

This species is reported to be widely distributed in the Indo-Pacific Region, but is comparatively rare in the Pamban area, whence only a single specimen, with the soft parts intact, is represented in the Museum collection. The shell is subject to much variation, and the Eastern forms are separated by some authors into a distinct species, *divaricata*. The shell is moderately small, transversely ovate, with more or less bluntly rounded anterior margin, and an angularly produced posterior margin. The valves bear a well developed oblique keel running backwards and downwards from the umbo to the hind margin. The valves close completely, and the ventral margin is feebly concave in the middle. The umbones are well raised and the ligamentary area is narrow and linear. The surface bears numerous, strong, raised, lamella-like concentric ridges separated by deeply excavated interstices which are traversed by short, narrow, raised radiating ridges. The concentric ridges are rendered more or less strongly nodular by intercrossing radial grooves. In the region behind the keel, however, the radial ridges predominate and divaricate strongly away from the direction of the keel as the umbo is approached. The shell is whitish, without any appreciable remains of the periostracum. Shingle Island.

Arca inaequivalvis Bruguière.

Plate II, figs. 7*a* and 7*b*.

Arca inaequivalvis, Bruguière, Encyclopédie Méthodique, Vers. I, 1792, p. 106.
Arca inaequivalvis, Lamarck, Anim. sans vert., Ed. 2, VI, 1819, p. 472, No. 30.
Arca inaequivalvis, Reeve, Conch. Icon., II, 1844, *Arca*, pl. viii, fig. 54.
Arca inaequivalvis, Kobelt, in Martini-Chemnitz, Conch. Cab., VIII, 2 Abth., 1888, p. 40, pl. iii, fig. 1.
Arca hispida, Philippi, Abbild, u. Beschreib, neur. od. wenig gekannt., Conchyl., III, 1849, p. 86 (18), pl. v fig. 4.
Arca disparilis, Reeve, Conch. Icon., II, 1844, *Arca*, pl. ix, fig. 59.
Arca disparilis, Lamy, Journ. de Conchyl., LV, 1907, p. 256.
Arca (*Scapharca*) *rhomboidalis*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 26.

This is one of the commonest species of *Arca* occurring at Pamban, but as yet only empty valves have been collected. Shells of this species are thrown up on the beach in large numbers on Krusadai and Shingle Islands, and are particularly abundant in the shore area along the Kundugal border, where they are sometimes heavily stained with iron-impregnated sand and consequently appear blackish. The shell is moderately large and only slightly longer than high, the height being definitely greater in proportion to the length than in most of the preceding species. The ends of the hinge margin are more or less sharply angulated. The shell is inaequivalve, the umbo being placed in front of the middle. The posterior margin is definitely broader than the anterior, straight, and obliquely truncated, and rather produced below, while the anterior margin is rounded. There is no definite keel on the valves, though the posterior area is somewhat concavely depressed. The surface is strongly radiately ribbed, the ribs being broadly flattened, smooth, and numbering about thirty-three. The interstices between the ribs sometimes bear fine, transverse striae. The valves are very deep and the umbo rather strongly curved inwards. The ligamentary area is narrow and greatly elongate. The shell is whitish, sometimes tinged with yellowish brown or orange, and often secondarily stained greyish black. In fresh shells there is a thin, finely hairy periostracum, persisting mainly in the interstices between the ribs. The shell being rather thin, the external ribs often show through on the inner surface also. Kundugal Point, Krusadai and Shingle Islands.

Arca gubernaculum Reeve.

Plate II, figs. 8*a* and 8*b*.

Arca gubernaculum, Reeve, Proc. Zool. Soc. London, XII, 1844, p. 40.
Arca gubernaculum, Reeve, Conch. Icon., II, 1844, *Arca*, pl. iii, fig. 14.
Arca gubernaculum, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 266.
Arca gubernaculum, Martini-Chemnitz, Conch. Cab., VIII, 2 Abth., 1888, p. 107, pl. 28, figs. 5 and 6.
Arca luzonica, Reeve, Proc. Zool. Soc. London, XII, 1844, p. 44 (vide Edg. Smith).
Arca chalcanthum, Reeve, ibid., p. 44.
Arca (Anadara) gubernaculum, Lamy, Journ. de Conchyl., LV., 1907, p. 239.
Arca (Scapharca) indica, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 29

A few large empty valves and a small, young, spirit-preserved specimen are represented in the Museum collection. The shell is very large, thick and elongately ovate with considerably deep and inflated valves. The outline of the shell is regular. The ends of the hinge line are more or less bluntly angular. The posterior margin is rather broad, straight and more or less obliquely produced while the anterior margin is much narrower and evenly rounded. The umbones are very prominent and moderately curved inwards, but those of the two valves are separated by a fairly wide gap. The ligamentary area is large and broadly elliptical. The surface bears strong, broad, flattened radial ribs separated by very narrow but deep interstices. The ribs in the front and middle parts of the

surface are rendered more or less distinctly composite by fine, radial grooves (often a single one for each rib) which divide into three or four subsidiary grooves towards the ventral margin running on the flattened surfaces of the ribs, but the ribs on the posterior part of the shell are always simple and smooth. The edge of the inner surface of the shell is flattened and strongly toothed owing to the presence of the terminations of the external ribs. The shell is whitish, covered with a thick, blackish brown, bristly periostracum, remnants of which persist particularly towards the posterior end of the shell and in the interstices between the radial ribs even in partially worn shells.

A very small juvenile specimen of this species from Pamban with the soft parts intact, is also represented in the Museum collection. The shell measures about 4 mm. in length and rather elongated with the posterior margin more or less rounded and only slightly broader than the anterior. The surface is practically smooth for the most part, but the posterior area bears strong, widely separated, crested radial rows of stiff, brownish, bristly processes. Pamban and Shingle Island.

Arca tortuosa Linné.

Plate III, figs. 1*a* and 1*b*.

Arca tortuosa, Linné, Syst. Nat., Ed. X, 1758, p. 693, No. 139.
Arca tortuosa, Lamarck, Anim. sans vert., Ed. 2, VI, 1819, p. 460, No. 1.
Arca tortuosa, Reeve, Conch. Icon., II, 1844, *Arca*, pl. xiii, fig. 86.
Arca torta, Steenstrup, Morch, Cat. Conchyl. quae reliq., C.P. Kierulf, 1850, p. 33.
Arca tortuosa, Martini-Chemnitz, Conch. Cab., VIII, 2 Abth., 1888, p. 7, pl. i, figs. 1 and 2.
Parallelipedum tortuosum, Morlet, Journ. de Conchyl., XXXVII, 1889, p. 163.
Arca (Parallelipedum) tortuosa, Lamy, Journ. de Conchyl., LV, 1907, p. 108.
Arca (Trisidos) tortuosa, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 31.
Arca (Parallelipedum) tortuosa, Hornell, Common Molluscs, of South India, Mad. Fish. Bull., XIV, 1921, p. 155, fig. 37.
Arca tortuosa, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 33.

A few dead shells of this somewhat rare species have been collected at Pamban. The shell is rather thin, and may at once be distinguished from those of all the preceding species of this genus by its very peculiar markedly twisted shape, the almost perfectly straight and elongated hinge margin forming the axis of the twist. The hind margin is broad, expanded and rather squarely truncated, while the ventral margin is much narrower, sharply angular above where it meets the hinge, but evenly rounded in front and below. As a result of the pronounced twist in the valves, the anterior part of the shell is rendred almost horizontal extending in a plane entirely different from that of the vertical hind part of the shell. The valves are provided with a strong, angular and oblique keel running down from the umbo to the postero-ventral corner. The regions in front of and behind the angular keel are concavely depressed. The keel is sometimes, especially in young shells, less sharply angular. The umbones are small and closely approximated. The ligamentary area is

very narrow and linear. The shell bears an elegant sculpture of moderatley strong, close-set, radiating ridges conspicuously decussated by strong, concentric, growth striae. The radial ridges are almost entirely absent from the area behind the keel in the left valve. The shell is whitish, very faintly tinged with pale brown. Pamban.

Family GLYCIMERIDAE.

The shell is thick, rounded and of variable size. The umbo is usually situated in the middle. The ligament is external, with oblique thickenings. The hinge margin is curved with the median teeth usually reduced and the outer ones oblique. The animals are burrowing in habit, the byssus being absent.

This family includes a single genus, *Glycimeris*.

Genus **Glycimeris** Da Casta, 1778.

With the characters of the family.

A single species, *Glycimeris taylori*, also represented at Madras, has been recorded from Pamban.

Glycimeris taylori (Angas).

Plate III, figs. 2*a* and 2*b*.

Pectunculus taylori, Angas, Proc. Zool. Soc. London, 1879, p. 417, pl. xxxv, fig. 8.
Pectunculus taylori, Lamy, Journ. de Conchyl., LIX, 1911, p. 108.
Pectunculus taylori, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 156.
Glycimeris taylori, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V. No. 1, 1941, p. 35.

Empty shells of this species are moderately common on the beach at Krusadai, but no living specimen has yet been collected from the area. The shell is rather thick, small, rounded and almost as high as long. The umbones are small, almost central, and the hinge is markedly arched, the concavity of the arch facing ventrally. The hinge bears numerous simple, linear teeth (pliodont), but the median ones are rather reduced while the outer ones are stronger and more or less oblique. The inner edge of the hinge area extends as a curved shelf across the dorsal part of the interior of the valve. The shell bears a delicate sculpture of fine, close-set radiating ribs which are very finely linearly striated throughout. The margin of the inner surface of the valves is distinctly toothed. The outer surface of the shell is whitish, but definitely pale purplish towards the umbo and marked all over with irregular brown spots and markings. The inner surface of the shell is generally bright chestnut brown. The shells in the Museum collection are rather small, measuring a little more than about 10 mm. in height, but Mr. Crichton's collection contains much larger shells measuring over an inch in height. Pamban and Krusadai Island.

Family LIMOPSIDAE.

The shell is usually small, often with a bristly periostracum, whitish, or more rarely brownish, usually rounded or ovate and somewhat oblique. The ligament is short and more or less sunk. The hinge bears numerous teeth, but the teeth are sometimes few or even entirely wanting. The internal margin of the shell is either smooth or toothed.

A single species, belonging to the genus *Limopsis*, has been recorded from Pamban.

Genus **Limopsis** Sasso, 1827.

The shell is small or moderately large, rounded, usually more or less oblique, colourless and with a hairy periostracum. The outer surface of the shell bears a weak radial or concentric sculpture.

Limopsis belcheri (Adams & Reeve).

Plate III, figs. 3*a* and 3*b*.

Pectunculus Belcheri, Adams & Reeve, Zoology of the Voyage of H.M.S. "Samarang", Mollusca, 1848, p. 76, pl. xxii, fig. 5.
Limopsis Belcheri, Adams, H. & A., Genera of Recent Mollusca, II, 1858, p. 544.
Limopsis belcheri, Lamy, Journ. de Conchyl., LX, 1912, p. 119.
Limopsis belcheri, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 60, pl. ii, figs. 9—12.

Three valves of the shell of this species collected at Pamban are represented in the Museum collection. The shell is of moderate size, thick and slightly obliquely ovate, but the present specimens are definitely more broadly rounded and more evenly circular in profile than what is indicated by Prashad's figure quoted above. The anterior margin is slightly shorter than the posterior, and is broadly curved and merges evenly into the rounded ventral margin, while the posterior margin is comparatively straight. The hinge margin is moderately extensive and broadly curved. The hinge teeth are numerous, close-set, linear and parallel, there being two or three more of these teeth anterior to the ligament than behind it. The ligament is short and triangular. The umbones are small and placed just above the ligament. The shell bears a sculpture consisting of fine radial ridges crossed by concentric striae, the former, however, predominating. In fresh shells there is a distinct, hairy periostracum, but the shells represented in the collection are rather worn and are practically smooth. The margin of the inner surface extends as a well defined, flattened border about a millimetre in width, the external edge of which is finely crenulated. The shell is pale brownish with no definite colour markings. The shells represented in the collection appear to be fairly young specimens. Pamban.

Order Anisomyaria.

SERIES MYTILACEA.

Family MYTILIDAE.

The shell is very inequilateral, with the umbo situated either terminally at the anterior end or sub-terminally, very close to it. It is equivalve, often elongated, or narrowed or pointed anteriorly. The inner surface is generally pearly. The anterior adductor muscle is almost always much less strongly developed than the posterior (Anisomyarian condition). This family includes the horse mussels, date shells and their allies.

Six genera belonging to this family are represented at Pamban. They may be distinguished with the aid of the following key :—

1. Shell much elongated, sub-cylindrical, rounded posteriorly as well as anteriorly. Shell generally dark chestnut brown in colour. Animals usually boring into coral rock or timber .. .. .. *Lithophaga.*

—Shell less strongly elongate, not cylindrical or sub-cylindrical in shape, usually broader and shorter, narrowed or even more or less pointed anteriorly, and rather broadly rounded posteriorly. Animals generally found attached, rather than boring 2

2. Umbo terminal, shell thick and solid, more or less irregularly triangular in shape, moderately broad, the hind end being broader in proportion to the length of the shell 3

—Umbo distinctly sub-terminal. Shell thinner, and usually with a conspicuous, hairy periostracum when fresh. Shell narrower at hind end in proportion to the length of the shell, and generally angularly and obliquely produced behind 5

3. Shell large, thick, with a tough, parchment-like dark green periostracum. Surface of shell generally smooth and unsculptured. Ligament somewhat elongated and extensive .. .. *Mytilus.*

—Shell smaller, and generally comparatively short, solid, without characteristic greenish periostracum as in the above. Surface usually with well-marked radial sculpture. Ligament moderately short 4

4. Shell with the front margin rounded or truncated, without a calcareous internal septum-like plate at the angle of the umbo. Lower margin of shell curved in front .. .. *Brachyodontes.*

—Shell with front margin angular and pointed, and with a characteristic, small, triangular, shelf-like, calcareous internal plate at the umbonal angle, to which the anterior adductor muscle is attached. Lower margin of shell not markedly curved in front .. .. *Septifer.*

5. Shell very small, sometimes even minute, more or less elongated, usually obliquely ovate. Outer surface generally radially sculptured in front and behind, the intervening portion of the surface being smooth. Shell without an oblique keel extending from the umbo to the ventral margin. Attachment of the anterior adductor muscle nearer the lower margin than usual .. *Musculus.*

—Shell much larger, thin, portions of its surface being usually hairy. Surface of shell always smooth and unsculptured. Middle part of the valves usually raised in the form of a more or less definite, oblique keel, running from the umbo to the lower end of the posterior border. Attachment of anterior adductor muscle normal in position .. .. *Modiolus.*

Genus **Modiolus** Lamarck, 1799.

(Syn. **Modiola** Lamarck, 1801).

The shell bears a blunt anterior extremity to which the umbo is more or less closely approximated, but the umbo is never terminal. The outer surface of the shell is smooth or hairy. The ligament is moderately long, external, and the hinge toothless.

Four species are represented at Pamban. They may be distinguished as follows :—

1. Shell thin, small, smooth, with a somewhat glossy surface, without concentric striae. Surface of shell sometimes covered with a hairy epidermis towards the margin 2

—Shell thicker and larger. Surface of shell much coarser in appearance, finely concentrically striated. Marginal portion of surface never covered with a hairy epidermis 3

2. Shell very thin and fragile, transparent-white, tinged with pale green, narrow and elongated. Surface of shell smooth and glossy. Upper border of shell only slightly angulated in the middle .. *M. perfragilis.*

—Shell slightly thicker, broader and slightly larger, with a broad, purplish red radiating band extending obliquely down from the umbo. Surface covered with a hairy epidermis at least partially. Upper border of shell more markedly angular about the middle. .. .. *M. metcalfei.*

3. Shell large. Surface of shell traversed by fine, concentric striae, dark brownish in colour, but definitely paler in the middle along and below a line extending obliquely down from the umbo. Lower margin of shell slightly concave in the middle .. .. *M. tulipa.*

—Shell smaller and proportionately more solid. Concentric striae on the surface finer and more closely set. Colour reddish brown in the middle, brownish towards the margin. Posterior side of shell proportionately more strongly inflated. Lower margin of shell not appreciably concave in the middle .. .. *M. traillii.*

Modiolus metcalfei (Hanley).

Plate III, figs. 4*a* and 4*b*.

Modiola metcalfei, Hanley, Cat. Recent Bivalve Shells, 1843, p. 235, pl. 24, fig. 25.
Modiola metcalfei, Hanley, Proc. Zool. Soc. London, XII, 1844, p. 14.
Modiola metcalfei, Reeve, Conch. Icon., X, 1858, *Modiola*, pl. iv, fig. 16.

Modiola metcalfei, Martini-Chemnitz, Conch. Cab., VIII, 3 Abth., 1889, p. 116, pl. 32, figs. 3 and 4.
Modiola metcalfei, Dunker, Index Moll. Mar. Japonicum, 1882, p. 223.
Modiola metcalfei, L. Morlet, Journ. de Conchyl., XXXVII, 1889, p. 161.
Modiola metcalfei, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 35.
Modiolus metcalfei, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 36.

This is the commonest species of *Modiolus* collected at Pamban, and is well represented in the Madras area also. Numerous dead shells from the beach as well as a few live specimens collected from the reefs are represented in the collection. The shell is moderately large and rather thin, with a fine iridescent lustre on its inner surface. The outline is shaped roughly like a transversely elongate triangle, the anterior margin being bluntly angular, with the umbo placed close behind it and a narrowly rounded posterior margin. The upper margin is markedly angular about the middle. The outer surface is smooth, or occasionally very minutely striated, but is often covered with a fine, brownish, hairy periostracum which is mostly confined to the upper and posterior portions of the surface. The shell valves are markedly raised along the middle in the form of a more or less distinct, obtuse keel running obliquely down from the umbo to the hind end of the lower margin. The shell is pale yellowish horny brown, marked with a conspicuous purplish red, broad, triangular band radiating from the umbo, the lower margin of this band coinciding approximately with the position of the keel. The umbo and the part of the shell immediately below the keel is very pale, almost whitish, and is sharply demarcated from the dark coloured zone above. The anterior adductor impression is large and opaque-white. Pamban, Krusadai and Shingle Islands.

Modiolus perfragilis (Dunker).

Plate III, fig. 5.

Volsella perfragilis, Dunker, Proc. Zool. Soc. London, 1856, p. 362.
Modiola perfragilis, Reeve, Conch. Icon., X. 1858, *Modiola*, pl. viii, fig. 42.
Modiola perfragilis, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 276.
Modiola perfragilis, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 38.

This species is rare at Pamban, and is represented in the Museum collection by a single dead shell. The shell is rather narrow and elongated, very thin, fragile and translucent. The shell is longer in porportion to the height than in any of the remaining species of *Modiolus* recorded from Pamban. The anterior end is narrowed and rather obtusely angular, while the posterior margin is slightly more broadly rounded. The upper margin is only very feebly angular about the middle. The surface is highly glossy, but traversed by very minute decussating striae. The longitudinal striae are slightly more pronounced than the concentric. The shell is whitish, tinged with a delicate pale green. The shell is smaller than that of any of the remaining species of *Modiolus* collected at Pamban. The single specimen in the Museum collection measures about 16 mm. in length and 6 mm. in breadth at it widest part. Pamban.

Modiolus tulipa (Lamarck).

Plate III, figs. 6*a* and 6*b*.

Modiola tulipa, Lamarck, Anim. sans vert., VII, 1836, p. 18.
Modiola tulipa, Reeve, Conch. Icon., X, 1858, *Modiola*, pl. iv, fig. 15.
Modiola tulipa, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 160.

Three shell valves of this rather uncommon species are represented in the Museum collection. The shell is rather large and moderately thick, with its outer surface traversed throughout by fine concentric striae. The shell bears a prominent oblique keel along the middle from the umbo as in *M. metcalfei*. The region above this raised part is concave near the umbo. The lower margin of the shell is slightly concavely indented about the middle. The outer surface of the shell is glossy and yellowish brown in colour, but the part just below the raised median keel is usually more or less sharply marked off from the rest of the surface as a broad, conspicuous, radiately widening whitish band. On the inner surface, the upper half is purplish and is demarcated very sharply from the bluish white lower half by an oblique line passing from the umbo to the hind lower corner of the shell. The shell is nearly twice as long as high. The specimens in the collection are fairly large, and measure on an average about 70 mm. in length and 36 mm. in height at the widest part. Pamban.

Modiolus traillii (Reeve).

Plate IV, fig. 1.

Modiola traillii, Reeve, Conch. Icon., X, 1858, *Modiola*, pl. iv, figs. 13 and 14.
Modiola traillii, Dunker, Index Moll. Mar. Japonicum, 1882, p. 222.
Modiola traillii, Kuster, Conch. Cab., VIII, 1889, pl. xxx, fig. 6.

This species is as rare as the preceding one, only a single dead shell being represented in the Museum collection of Pamban bivalves. The shell is moderately large, and fairly thick. The surface bears well developed concentric striae. The umbo is very nearly terminal. The shell is more elongated in proportion to the height than in *M. tulipa*, being decidedly more than twice as long as high. The anterior border of the shell is not so broadly expanded as in *M. tulipa*, and the lower margin of the shell is almost perfectly straight instead of being concave as in that species. The posterior part of each valve is proportionately much deeper (that is to say, more strongly inflated) than in any of the other species of *Modiolus* recorded from Pamban. The central and upper portions of the surface are dark reddish brown, while the part adjoining the umbo is purplish white. The inner surface of the valve is more or less uniformly bluish white and bears a slight pearly lustre. Pamban.

Genus **Brachyodontes** Swainson, 1840.

(= **Brachidontes**).

The shell is usually radiately sculptured, with front margin somewhat rounded or truncated. The umbo is almost or entirely terminal. The ligament is moderately short.

Thiele has included *Septifer* as a sub-genus under the genus *Brachyodontes*, but I have followed Lynge in treating the two as distinct genera in view of the easily recognisable differences between the two.

This genus is represented at Pamban by a single species.

Brachyodontes variabills (Krauss).

Plate IV, fig. 2.

Mytilus variabilies, Krauss, Sudafr. Moll., 1848, p. 25, pl. ii, fig. 5.
Mytilus exustus, Vaillant, Journ. de Conchhl., 1865, XIII, p. 114.
Mytilus pharaonis, Fischer, P., Journ. de Conchyl., XVIII, 1870, p. 169.
Mytilus variabilis, Cooke, Ann. & Mag. Nat. Hist., (5), XVII, 1886, p. 137.
Mytilus variabilis, Sowerby, Marine Shells, South Africa, 1892, p. 64.
Mytilus variabilis, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 799.
Modiola variabilis, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 160.
Brachyodontes variabilis, Tomlin, Trans. Zool. Soc. London, XXII, 1927, p. 302.
Brachidontes variabilis, Prashad, Siboga-Expeditie, Pelecpoda, Monogr. CXVIII, 1932, p. 66.

This species, which is widely distributed in the Indo-Pacific Region, is represented in the Museum collection by three spirit-preserved specimens collected from coral rock at Pamban. It is closely allied to *B. exustus* (= *Mytilus exustus*, Reeve, Conch. Icon., X, 1858, *Mytilus*, pl. iv, fig. 10). The shell is short and triangular in outline. The front margin is bluntly rounded and the umbo is nearly terminal. The posterior margin is rather broadly expanded and rounded, and leads gradually on to the relatively short dorsal margin. The region adjoining the umbo is somewhat inflated while posteriorly the valves are compressed. The lower margin is slightly concave. The surface bears an elegant sculpture of fine, close-set, radiating ribs, some of which bifurcate towards the posterior margin. The greater part of the margin of the shell presents a finely crenulated appearance in a internal view owing to the presence of the radial sculpture. The adductors are well developed, but unequal, the posterior being much larger than the anterior. The foot bears a fine, tuft-like byssus. The interior of the valves is pearly. The shell is pale yellowish brown, tinged with deep purplish grey towards the posterior margin. The specimens are small, and are about 9 mm. in length and 6 mm. in height at their widest part. The animals bore into coral rock. Pamban.

Genus **Septifer** Récluz, 1848.

The shell bears a pionted, terminally situated umbo, and always a calcareous plate internally at the anterior angle, to which the anterior adductor muscle is attached.

A single species, *S. bilocularis,* also known from the Madras area, has been recorded from Krusadai.

Septifer bilocularis (Linné).

Plate IV, figs. 3*a* and 3*b*.

Mytilus bilocularis, Linné Syst. Nat., Ed. X, 1758, p. 705.
Mytilus nicobaricus, Chemnitz, Conch. Cab., VIII , 1785, p. 155, pl. 82, figs. 736–37.
Septifer bilocularis, Récluz, Revue Zool., 1848, p. 278.
Mytilus nicobaricus, Reeve, Conch. Icon., X, 1858, *Mytilus*, pl. ix, fig. 42.
Tichogonia bilocularis, Martini -Chemnitz, Conch. Cab., VIII, 3 Abth., 1889. p. 10, pl. ii, figs. 11–17.
Septifer bilocularis, Dunker, Index Moll. Mar. Japonicum, 1882, p. 227.
Septifer bilocularis, Smith, " Challenger ", Zoology, XIII, 1885, Lamellibranchiata, p. 271.
Septifer bilocularis, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 39.
Brachyodontes (Septifer) bilocularis, Thiele, Faun. Sudwest Austral., V, 1930, p. 590.
Brachidontes (Septifer) bilocularis, Prashad, Siboga- Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 69.

This species is widely distributed in the Indo-Pacific Region, and its variablity, both in form and colour, has been largely responsible for the different names by which this species had been known by various authors. There are two valves from Pamban in Mr. Crichton's collections labelled "*S. nicobaricus* ", but this is synonymous with *S. bilocularis,* which is the only species of this genus collected at Pamban. The shell is of moderate size, fairly thick, and of a somewhat variable outline. As a rule, the shell is roughly triangularly ovate, with the posterior margin rounded, the lower margin slightly concave, the dorsal margin more or less straight and parallel to the lower, and the anterior margin rather strongly obliquenly truncated. The umbo is situated terminally and the umbonal end is strongly angular, slightly curved and beak-like. The surface bears a strongly marked sculpture of fine, well developed radial ridges which are more or less distinctly granular or crenulated, bifurcating here and there and diverging in a fan-wise manner towards the posterior margin. In addition to the radial ribs, there are strongly marked, widely spaced, concentric growth ridges which give the surface of full-grown shells a markedly terraced appearance. Internally there is a rather thin, triangular, calcareous, shelf-like plate at the angle of the umbo in each valve. The margin of the inner surface is finely crenulated almost throughout, except at the concave lower part. The shell is rather variable in colour. The outer surface is commonly greenish blue, tinged with red towards the lower margin, but many of the dead shells washed up on the beach are generally bright orange red, sometimes tinged with purple. The inner surface is deep bluish grey. The shells are generally 20 to 30 mm. in length, but there are large shells from Singapore in Mr. Crichton's collections

measuring well over 40 mm. in length. Living specimens have also been collected from crevices in coral rock on the reefs. Krusadai and Shingle Islands.

Genus **Musculus** (Bolten) Röding, 1798.

(Syn. **Modiolaria** Beck, 1838).

The shell is more or less elongated, usually obliquely ovate. The umbo is placed near the front end. The outer surface is radially ribbed in front and behind, the intervening part being smooth. The inner margin bears granules.

This genus is designated by some authors by its later name, *Modiolaria*. The shell is very similar in general appearance to that of *Modiola*, but the posterior mantle opening bears a long siphon in this genus.

Two species from Pamban, namely, *M. cumingianus* and *M. nanus* are represented in the Museum collection. The former may be readily distinguished by the shell being slightly larger, more inflated, the radial sculpture being much less strongly developed, and a relatively greater portion of the surface being smooth and even markedly glossy.

Musculus cumingianus (Dunker).

Plate IV, fig. 4.

Modiola cumingiana, Dunker, MS. Mus. Cuming, 1858.
Modiola cumingiana, Reeve, Conch. Icon., X. 1858, *Modiola*, pl. ix, sp. 50, figs. 63 a and b.
Modiolaria cumingiana, Martini-Chemnitz, Conch. Cab., VIII, 3 Abth., 1889, p. 146, pl. 34, figs. 2 and 3.
Crenella (Modiolaria) cumingiana, Angas, Proc. Zool. Soc. London, 1865, p. 653.
Modiolaria cumingiana, Smith, " Challenger ", Zoology, XIII, 1885, Lamellibranchiata, p. 278.
Modiolaria cumingiana, Lynge, Marine, Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 43.

Two shells from Pamban, measuring about 4 mm. long and 3 mm. high are represented in the Museum collection. The shell is very small, oblong-ovate, with the anterior margin slightly narrower than the posterior. It is somewhat thin, with a slight, translucent gloss on the surface. The shell is rather inflated in the region of the umbo, but considerably compressed towards the posterior margin. The valves are feebly and obtusely angulated along an oblique line extending downwards and backwards from the umbo. The surface is very faintly and finely ridged at the extreme anterior part and towards the posterior border, the intervening area comprising the greater part of the surface being smooth and even glossy. The shell is pale horny brown, with minute reddish brown streaks towards the margin. Pamban.

Musculus nanus (Dunker).

Plate IV, fig. 5.

Lanistina nana, Dunker, Proc. Zool. Soc. London, XXIV, 1856, p. 365.
Modiola nana, Reeve, Conch. Icon., X, 1858, *Modiola*, sp. 56, pl. x, fig. 69.
Crenella nana, Clessin, in Martini-Chemnitz, Conch. Cab., VIII, 3 Abth., 1889, p. 152, pl. 34, fig. 10.
Modiolaria nana, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 43, pl. ii, fig. 15.

A single dead shell from Pamban is represented in the Museum collection. The shell is minute, barely attaining a length of 3 mm. but Lynge records specimens from the Gulf of Siam measuring as much as 13 mm. in length. The Museum specimen appears to be a very young shell. The shell is obliquely ovate, with the umbo slightly subterminal and beak-like, the anterior margin somewhat narrowed and the posterior margin rather broadly expanded. The dorsal margin is more or less distinctly obtusely angled in the middle. The shell is thin, delicate and almost semi-transparent. The surface of the shell bears fine, close-set ridges radiating from the umbo. The ridges extend over a proportionately greater part of the surface on the posterior half of the shell than in the preceding species. The valves are also not obtusely and obliquely angulated along the middle as in *M. cumingiana*. The shell is pale horny yellowish, very finely variegated with reddish brown markings but the latter can hardly be made out in the present specimen which is rather badly faded. Pamban.

Genus **Lithophaga** (Bolten) Röding, 1798.

(Syn. **Lithodomus** Cuvier, 1817).

The shell is more or less elongated, cylindrical or subcylindrical, with the umbo situated either very close to the rounded anterior end, or terminal. The outer surface is smooth or wrinkled. The hinge margin is elongated, smooth, and the ligament long and sunk. The mantle bears shorter or longer siphons. The animals generally burrow in coral rock.

Five species have been recorded from Pamban. They may be distinguished as follows :—

1. Shell not markedly elongated, rather thick, strongly inflated and conspicuously arched. Anterior extremity more or less abruptly truncated. Surface finely decussately striated throughout.	*L. cinnamomea.*
—Shell not of the above form, but greatly elongated and cylindrical, thinner and comparatively less strongly inflated. Anterior extremity rather narrowly rounded. Surface with perpendicular furrows below the diagonal from the umbo to the hind lower margin	2

2. Shell pale horny brown or rather straw-coloured, anteriorly rather more strongly inflated. Maximum height of shell greater in proportion to the total length than in the succeeding species, the shell being just about three times as long as high. Perpendicular furrows frequently divaricating .. .. *L. stramineus.*

—Shell much darker in colour, generally deep chestnut. Anteriorly less strongly inflated. Maximum height of shell much less in proportion to the total length, the shell being decidedly more than three times (and sometimes even nearly four times) as long as high. Perpendicular furrows more or less normal 3

3. Shell rather small. Dorsal margin of shell rather sharply angulated in the middle. Perpendicular furrows on the surface shallow, faintly impressed, rather fine and very close-set. Shell more strongly cylindrical and posterior margin of shell much less flattened .. .. .. *L. teres.*

—Shell decidedly larger. Dorsal margin of shell rather convex, but not sharply angulated in the middle as above. Perpendicular furrows deeper, stronger and coarser. Shell less perfectly cylindrical, being more compressed. Posterior margin of the valves more strongly flattened .. 4

4. Shell very dark-coloured, almost blackish brown. Anterior end more markedly narrowed and dorsal margin more strongly convex .. .. .. *L. gracilis.*

—Shell slightly paler, light chestnut-brown. Anterior end not markedly narrowed and about as wide as the posterior. Dorsal margin less strongly convex .. .. *L. nigra.*

Of the five species enumerated above, *L. stramineus*, *L. teres* and *L. nigra* are much commoner at Pamban than the remaining two, of which *L. gracilis* is represented by a single dead shell in Mr. Crichton's collection, and *L. cinnamomea* by a spirit specimen in the Museum collection.

Lithophaga teres (Philippi).

Plate IV, figs. 6*a* and 6*b*.

Modiola teres, Philippi, Abbild. Beschreib., Conch., II, 1846, p. 148, *Modiola*, pl. i, fig. 3.
Lithodomus teres, Reeve, Conch. Icon., X, 1858, *Lithodomus*, pl. iii, fig. 13.
Lithophaga teres, Dunker, in Martini-Chemnitz, Conch. Cab. (N.F.), VIII, (3), 1883, *Lithophaga*, pl. 13.
Lithodomus teres, von Martens, Journ. Linn. Soc. London (Zoology), XXI, 1887, p. 206.
Dactylus erythraeensis, Jousseaume, Mém. Soc. Zool. France, I, 1888, p. 218.
Lithophagus teres, Melvill & Standen, Journ. de Conchyl., IX, 1898, p. 81.
Lithophaga teres Hedley, Proc. Linn. Soc. N.S. Wales, XXXI, 1906, p. 464.
Lithodomus teres, Melvill, Trans. Linn. Soc. London (Zoology), XIII, 1909 , p. 124.
Lithophaga (Lithophaga) teres, Prashad, Siboga- Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 77.

This species is closely allied to *L. gracilis* and Lynge observes that the two cannot be separated from each other, but Prashad treats it as a separate species. It is distinguished from *L. gracilis* by its much smaller size, more perfectly cylindrical shape and the more marked flattening of the posterior part of the valves. The shell is rather small and cylindrical with a fine gloss over the surface. It is fully over three times as long as high. The dorsal margin of the shell is slightly but distinctly and sharply angulated in the middle. The posterior and anterior margins are about equally wide and rounded. The parallel, perpendicular furrows on the ventral and anterior parts of the surface are much finer and more closely set than in most of the other species recorded from Pamban. The furrows disappear at a considerable distance away from the posterior margin ventrally, thus leaving a large area at the hind part of the surface entirely smooth. The shell is deep chestnut in colour. Both dead shells from the beach and living specimens from coral rock on the reefs have been collected. Pamban, Krusadai and Shingle Islands.

Lithophaga gracilis (Philippi).

Plate IV, figs. 7*a* and 7*b*.

Modiola (Lithophagus) gracilis, Philippi, Zeitschr. f. Malak., 1847, IV, p. 117.
Modiola gracilis, Philippi, Abbild. u. Beschreib. neuer od. wenig gek. Conchyl., 1851, III, p. 5, (19), pl. ii, fig. 1.
Lithodomus gracilis, Reeve, Conch. Icon., X, 1858, *Lithodomus*, pl. i, fig. 4.
Lithodomus gracilis, Fischer, P., Cat. de Moll. de l'Indo-Chine, 1891, p. 213.
Lithophaga gracilis, Dunker, in Martini-Chemnitz, Conch. Cab., 1882, VIII, 3 Abth., p. 12, pl. iv, figs. 7 and 8.
Lithodomus gracilis, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 40.

A single shell from Pamban is contained in Mr. Crichton's collection. The shell is moderately large, elongated and cylindrical, with the dorsal margin rather markedly convex in the middle. The anterior margin is slightly more narrowly rounded than the posterior. The perpendicular furrows are deep and strongly marked, and many of them bifurcate into finer grooves in the upper half of the surface towards the anterior margin. The shell valves are rather strongly compressed towards the posterior margin. The interior of the shell is smooth, glossy and pale bluish grey, with a slight pearly lustre. Externally, the shell is

very dark chestnut-coloured, almost blackish brown. The present specimen is much smaller than what is indicated by Reeve's figure, and is probably not a full-grown one. Pamban.

Lithophaga nigra (d'Orbigny).

Plate IV, fig. 8.

Lithodomus nigra, d'Orbigny, in Sagra, Hist. Cuba Moll., II, 1845, p. 331, pl. xxviii, figs. 10 and 11.
Modiola (Lithophagus) antillarum, Philippi (non d'Orbigny) Zeitschr. f. Malak., IV, 1847, p. 116.
Modiola (Lithophagus) caribaea, Philippi, ibid., p. 116.
Mytilus lithophagus, Gibbes, (non Lamarck), Cat. South Carol., 1848, pl. xxii.
Lithodomus nigra, Morch, Cat. Conch. Yoldi, II, 1853, p. 56.
Lithodomus Antillarum, Reeve, Conch. Icon., X, 1857, *Lithodomus*, pl. ii, fig. 7.
Lithodomus Antillarum, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 276.
Lithophagus Antillarum, Dall, Bull. U.S. Nat. Mus., No. 37, 1889, p. 38.
Lithophaga nigra, Dall, Tert. Fauna Florida, 1898, p. 799.
Lithodomus antillarum, Hornell, Common Mollusca of South India, Mad. Fish. Bull., XIV, 1921, p. 161.
Lithophaga nigra, Lamy, Journ. de Conchyl., LXXXI, 1937, p. 114.

This species is moderately common and both dead shells and spirit-preserved specimens collected from coral burrows are represented in the Museum collection, under the label *L. antillarum*, which name has been widely used for this species by various authors (*e.g.*, Reeve and Smith). *L. antillarum* d'Orbigny, however, is a different species, quite distinct from the present one, and corresponds to *L. corrugata* of Reeve. The shell is somewhat large and resembles that of the preceding species in many respects. The anterior and posterior ends are more or less equally narrow and rounded. The proportion of the height of the shell to its length is much the same as in *L. teres* and *L. gracilis*. The dorsal margin of the shell is only slightly convex. The perpendicular furrows on the anterior and ventral parts of the surface are well marked and sometimes tend to be slightly wrinkled or flexed. The umbonal ends of the valves are rather deep, while posteriorly they are relatively flattened. The shell is chestnut-brown in colour. Pamban and Krusadai Island.

Lithophaga stramineus (Dunker).

Plate IV, fig. 9.

Lithodomus stramineus, Dunker, MS., Reeve, Conch. Icon., X, 1857, *Lithodomus*, pl. ii, fig. 11.
Lithodomus lithophagus, Mabille et le Mesle (non Lamarck), Journ. de Conchyl., XIV, 1866, p. 118.
Lithophaga straminea, Dunker, in Martini-Chemnitz, Conch. Cab., VIII, 3 Abth., A, 1882, p. 6, pl. ii, figs. 1 and 2.
Lithophaga straminea, Hedley, Proc. Linn. Soc. N.S. Wales, XXX, 1906, p. 464.
Lithophaga straminea, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 41.
Lithodomus stramineus, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 161.
Lithophaga straminea, Lamy, Journ. de Conchyl., LXXXI, 1937, p. 117.

This species is moderately common at Pamban, whence living specimens have been frequently collected. The shell is fairly large and differs markedly from those of the preceding species in being almost always of a pale yellowish brown or straw colour, and in the

length of the shell being less in proportion to the maximum height of the shell. The shell is just about three times as long as high, while it is fully over four times as long as high in the preceding species. The shell is more or less cylindrical and the anterior part is rather inflated. The dorsal margin is slightly but distinctly angulated in the middle. The surface is ornamented with conspicuous concentric growth lines and the usual set of fine, perpendicular striae which, as a rule, are comparatively feebly developed in this species, but become more strongly marked, bifurcated and diverging towards the posterior part of the surface. The animals are found inhabiting coral burrows, and the shells are sometimes covered with calcareous encrustations. Pamban and Krusadai Island.

Lithophaga cinnamomea (Lamarck).

Plate IV, figs. 10*a* and 10*b*.

Mytilus cinnamomea, and *M. silicula*, Lamarck, Anim. sans vert., VI, 1819, pp. 114 and 115.
Modiola arcuata, Dufo (nec Lamarck), Ann. Sci. Nat. (Zool.), XIV, 1840, p. 215.
Modiola cinnamomea, Hanley, Cat. Recent Bivalve Shells, 1843, p. 238, pl. xxiv, fig. 24.
Lithodomus cinnamominus, Reeve (ex parte), Conch. Icon., X, 1858, *Lithodomus*, pl. i, figs. 5*a* and *b*.
Lithophaga fusca, Dunker, (ex parte), in Martini-Chemnitz, Conch. Cab., (N.F.), VIII, 1883 (3), *Lithophaga*, p. 25, pl. vi, figs. 8 and 9.
Lithophaga cinnamomeus, Cooke, Ann. & Mag. Nat. Hist., (5), XVIII, 1886, p. 141.
Botula cinnamomea, Jousseaume, Mém. Soc. Zool. France, I, 1888, p. 216.
Lithodomus cinnamomeus, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 802.
Lithodomus (*Botula*) *cinnamomea*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 42.
Lithophaga (*Botula*) *cinnamomea*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 79.

This species differs outstandingly from all the foregoing species of *Lithophaga*, and consequently it has been included by most authors under a separate sub-genus, *Botula* Morch. The shell is rather small, solid, and more or less D-shaped with a markedly arched contour. It has lost the typical elongated form of *Lithophaga* and looks more like that of *Septifer* at first sight. The arched appearance of the outline of the shell is due to a well marked concavity in the lower margin coupled with a corresponding convexity of the dorsal margin. The anterior margin is more or less squarely truncated, and the umbo protrudes distinctly a little beyond the level of the shell margin. The surface is very minutely decussately striated throughout. The shell is dark chestnut-brown in colour. The margin of the shell is slightly thickened. A single spirit-preserved specimen, extracted alive from a crevice in coral rock, is represented in the Museum collection. Pamban.

Genus **Mytilus** Linné, 1758.

The shell is pointed anteriorily, with a nearly or completely terminal umbo. The anterior margin usually bears a few small teeth. The anterior adductor muscle is small and sometimes wanting.

A single species, *Mytilus viridis*, which is the common 'horse mussel' of the Indian shores, has been recorded from Pamban.

Mytilus viridis, Linné.

Plate V, fig. 1.

Mytilus viridis, Linné Syst. Nat., Ed. X, 1758, p. 706, No. 220.
Mytilus viridis, Linné, Syst. Nat., Ed. XII, 1767, p. 1158, No. 259.
Mytilus smaragdinus, Chemnitz, Conch. Cab., VIII, 1785, pl. 83, fig. 745.
Mytilus smaragdinus, Reeve, Conch. Icon., X, 1858, *Mytilus*, pl. vii, fig. 28.
Mytilus viridis, Hanley, Cat. Recent Bivalve Shells, 1843, p. 247.
Mytilus (Chloromya) viridis, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 33.
Mytilus viridis, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 156, fig. 38.

This species is considerably rarer at Pamban than at Madras, and is represented in the Museum collection by only a single large shell from Pamban with both the valves intact, though numerous specimens have been collected from the harbour area at Madras. The shell is thick, large, and elongately triangular, with an angular, pointed front end, which is conspicuously arched and beak-like. The umbo is terminal. The shape of the outline of the shell is somewhat variable, but, as a rule, the posterior margin is broadly rounded, the lower slightly concave, and the dorsal rather angularly convex in the middle. The valves are more or less strongly inflated especially in the anterior part. The surface of the shell is strongly decussately striated. The ligament is strong and elongated. The shell is covered by a very thick, tenaceous, blackish green periostracum which peals off in crustaceous, horny flakes in old shells. This covering is bright greenish towards the margin, and extends round the edge a little distance on to the inner surface as a characteristic, glossy, greenish border all round. The single shell in the collection measures nearly 4½ inches in length and over 2½ inches in maximum height. The animals are attached by a well developed byssus to hard substrata like rocks during life. The inner surface is pearly and bears a fairly brilliant iridescence. Pearls of an inferior quality have been frequently extracted from the nacreous layer of the shell of this species. A few such pearls are exhibited in the shell gallery of the Museum. **Pamban.**

SERIES PTERIACEA.

Family ISOGNOMONIDAE.

(=VULSELLIDAE).

The shell is laterally compressed and more or less flattened, with a straight, toothless hinge. The ligament bears one or numerous horny nodules. The gill lamellae are, as a rule, smooth. This family includes the peculiar hammer oysters and their allies.

Three genera, *Isognomon*, (=*Pedalion*), *Vulsella* and *Malleus* are represented at Pamban. They may be distinguished as follows :—

1. Ligament with a series of strong, horny nodules, situated in sockets. Shell moderately high and not very narrow. Foot always with a byssus .. *Isognomon* (= *Pedalion*).

—Ligament with a single large nodule in an oblique, triangular groove. Shell high and narrow. Foot with or without a byssus 2

2. Foot without a byssus and retractor. Hinge margin short and sunk in a groove. Shell often gaping and margins not plaited .. .. .. *Vulsella.*

—Foot with a well developed byssus. Shell often with plaited margins and more or less strongly elongated hinge margin not sunk in a groove. Shell often completely closing, and margins conspicuously plaited .. .. *Malleus.*

Genus **Isognomon** (Klein) Solander, 1786.

[Syn. **Pedalion** (Solander) Huddesford, 1770].

The shell is nearly equivalve. The outer surface is often scaly. The umbo is situated at the anterior end of the hinge margin which is sometimes short, but sometimes posteriorly elongated. The ligament bears a series of stout, rounded nodules placed in sockets. The foot bears a byssus by which the shells are firmly attached to substrata such as coral rock and shingle.

The shells of the species of this genus are highly variable in form, and are difficult to separate. The following key, however, may prove helpful in distinguishing the Pamban species :—

1. Shell narrow and strongly elongated, straight or somewhat arched, and sometimes even slightly twisted. Auricles very small and poorly developed. Hinge area comparatively short .. ... *I. isognomum* var. *norma* (= *femoralis*).

—Shell not as above, broader in proportion to the height, and ovate and more rounded in outline. Auricles slightly more conspicuous. Hinge area longer 2

2. Shell rather broad, and outline more or less squarish or very slightly oblong. Surface covered with strong, widely spaced, concentric laminae, the laminae towards the ventral margin presenting a frilled appearance. Umbo rather conspicuously curved .. .. *I. nucleus.*

—Shell definitely narrower, more elongate in proportion to the width. Concentric laminae present, but thicker, more crudely developed, more unevenly spaced and not frilled towards the lower margin as in the above. Umbo not markedly curved 3

3. Shell rather narrow, long and tongue-shaped, fully more than twice as long as broad, not very strongly flattened. Hinge margin short and its ends not prominently angulated. Shell dull greyish white .. .. *I. legumen.*

—Shell definitely broader, being a little over one and a half times as long as broad, rather strongly flattened. Hinge margin longer, and its ends more sharply angular. Front margin immediately below the umbo abruptly sinuated. Shell purplish black .. .. *I. isognomum* var. *canina.*

Isognomon nucleus (Lamarck).

Plate V, figs. *2a* and *2b*.

Perna nucleus, Lamarck, Anim. sans vert., Ed. 2, VII, 1836, p. 78, No. 10.
Perna nucleus, Reeve, Conch. Icon., XII, 1860, *Perna*, pl. i, fig. 4.
Perna pectinata, Reeve, ibid., pl. i, fig. 2.
Perna quadrangularis, Reeve, ibid., pl. ii, fig. 6.
Perna nucleus, Martini-Chemnitz, Conch. Cab., VIII, 1 Abth., 1890, p. 36, pl. xiii, fig. 1.
Melina nucleus, Lamy, Bull. Mus. d'Hist. Nat. Paris, 1906, p. 314, No. 70.
Perna nucleus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 52.
Isognomon nucleus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 37.

This is the commonest species of *Isognomon* occurring at Pamban and numerous specimens have been found alive attached closely to coral rock on the reefs, particularly on Shingle Island. The shell is rather small and more or less squarely ovate in outline, with a straight hinge margin and rather irregularly rounded lower margin. The shell is normally about as high as long or slightly longer than high, but the shape is subject to great variation and it may often be more strongly elongated. The surface bears thin, raised, widely and more or less evenly spaced concentric laminae, which are somewhat frilled or crenulated towards the ventral margin. The umbones are pointed, arched and beak-like. The beaked appearance of the umbo is more strongly marked in some specimens than in others. The marginal part of the shell, especially on the ventral side is very thin. The shell is pale olive brownish in colour. Several spirit-preserved specimens as well as

dry shells are represented in the Museum collection, the largest measuring about 20 mm. high and 9 mm. broad, but the other specimens are much smaller. Krusadai and Shingle Islands.

Isognomon legumen (Gmelin).

Plate V, figs. 3*a* and 3*b*.

Ostraea legumen, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3339.
Perna dactylus, Valenciennes, Encyclopédie, Méthodique, 1791, pl. clxxv, figs. 2 and 3.
Perna legumen, Lamarck, Anim. sans vert., VI, 1819, p. 142.
Ostraea Legumen, Wood, Index Test., 1825, p. 53, pl. xi, fig. 83.
Isognomon legumen, Adams, H. & A., Genera of Recent Mollusca, II, 1857, p. 527.
Perna caudata, *P. linguaeformis*, *P. laticostata*, *P. legumen*, Reeve, Conch. Icon., XII, 1860, *Perna*, pl. i, fig. 5, pl. ii, figs. 7, 9 and pl. v, fig. 22.
Perna legumen, Jousseaume, Mém. Soc. Zool. France, I, 1888, p. 219.
Perna spengleri, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 56.
Isognomon legumen, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 87.

This species is less common than the preceding one and is represented in the Museum collection by two spirit-preserved specimens, besides a few dead shells labelled *I. linguaeformis* (which is a synonym for *I. legumen*) in Mr. Crichton's collection. The shell is usually much more strongly elongated than in the preceding species, and is fully over twice and sometimes nearly thrice as long as broad. It is narrow, with more or less straight and parallel lateral margins. The lower margin is rounded or truncated. The hinge margin is short and its ends bluntly angular. The front margin of the valves immediately below the umbo is sometimes slightly sinuated. The surface bears coarse concentric laminae which are closer and more regular towards the umbo, but becomes irregularly plaited distally. The shell is dull whitish, tinged with a pale dirty brown and pale bluish grey towards the umbo. The shell is fairly large, the two spirit-preserved specimens measuring 30 mm. and 40 mm. long, and 10 mm. and 19 mm. broad respectively. Pamban and Krusadai Island.

As already diagnosed in the key above, the two varieties of *Isognomon isognomum* recorded from Pamban differ strikingly from each other, and are described separately.

Isognomon isognomum (Linné), var. **canina** (Lamarck).

Plate V, fig. 4.

Perna canina, Lamarck, Anim. sans vert., VI, 1819, p. 141.
Ostraea Isognomon, Wood, Index Test., 1825, p. 53, pl. xi, fig. 79.
Perna isognomum, Sowerby, Genera of Shells, II, 1830, fig. 1.
Perna isognomum, Reeve, Conch. Syst., 1841, p. 147, pl. cvi, fig. 1.
Perna canina, Catlow & Reeve, Conch. Nomencl. 1844, p. 77.
Perna fimbriata, *P. patibulum*, *P. vespertilio*, Reeve, Conch. Icon., XI, 1860, *Perna*, pl. iv, figs. 18 and 19; pl. vi, fig. 26.
Melina isognomum, var. *canina*, Lamy, Mém. Soc. Zool. France, XXII, 1909, p. 339.
Pedalion vespertilio, Faustino, Summ. Phil. Mar. Freshw. Mollusks, 1928, p. 25.
Isognomon isognomum, var. *canina*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 83.

This form is comparatively scarce at Pamban and only a single spirit-preserved specimen is represented in the Museum collection. The shell is fairly large, with the valves more or less strongly flattened. It is rather broad and elongate, being about one and a half times as high as broad, and only very slightly arched. The auricle (i.e., the projection of the hinge margin) is short, blunt and more or less triangular and the front marginal gape is rather deeply sinuated below the umbo. The surface is concentrically laminated, but the laminae are thinner and less strongly developed than in the preceding species. The shell is deep purplish black, rayed with whitish bands radiating from the umbo. The single specimen in the collection measures 34 mm. long and 23 mm. broad. In this variety, the shell is comparatively broader than in the typical form. Shingle Island.

Isognomon isognomum (Linné), var. **norma** Röding.

Plate V, figs. *5a* and *5b*.

Isognomon norma, Röding, Mus. Boltenianum, 1798, p. 168.
Perna tranquebaricus, Leach, Zool. Miscell., II, 1815, p. 142, pl. cxiv.
Perna femoralis, Lamarck, Anim. sans vert., VI, 1819, p. 140.
Perna femoralis, Blainville, Man. Malacol., 1825, p. 528, pl. lxiii, fig. 1.
Perna isognomum, Reeve, Conch. Icon., XII, 1860, *Perna*, pl. v, fig. 24.
Perna femoralis, Chenu, Man. de Conchyl., II, 1862, p. 161, fig. 802.
Perna femoralis, Smith, Proc. Zool. Soc. London, 1891, p. 435.
Perna femoralis, Melvill & Standen, Journ. de Conchyl., IX, 1898, p. 81.
Isognomon isognomum var. *norma*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 84.

This form is represented by a few dead shells from Pamban in Mr. Crichton's collections (labelled *Pedalion femoralis*). The shell may at once be distinguished from those of the foregoing forms by its being much more strongly elongated, narrow, straight or only slightly arched, and sometimes even somewhat twisted. The shell becomes particularly narrow and constricted at about the level of two-thirds of its length from the hinge and again slightly widens out towards the lower margin, thus giving a peculiar "pinched" appearance to this part of the shell. The hinge margin is very short and the auricles are very inconspicuous and almost obsolete. The surface bears strong and rather crudely developed concentric laminae which are more or less closely overlapping towards the hinge margin but become few and widely spaced in the lower half of the shell. The shell is about four to five times as high as broad. A fair-sized shell in Mr. Crichton's collection measures 30 mm. long and 6 mm. wide. The shell is purplish brown in colour. Pamban.

Genus **Vulsella** (Bolten) Röding, 1798.

The shell is rather high and narrow, often gaping, with a short hinge margin bearing a single strong nodule in an oblique, triangular socket. The hind margin is often somewhat concave. The foot is without a byssus and a retractor.

A single species has been recorded from Pamban.

Vulsella vulsella (Linné).

Plate V, figs. 6*a* and 6*b*.

Mya vulsella, Linné, Syst. Nat., Ed. X, 1758, p. 671, and Ed. XII, 1767, p. 1113.
Vulsella major, Röding, Mus. Boltenianum, 1798, p. 156.
Vulsella lingulata, *V. hians*, *V. mytilina*, Deshayes, in Lamarck, Anim, sans vert., VII, 1836, p. 267 and 268.
Vulsella lingulata, *V. mytilina*. *V. trita*, Reeve, Conch, Icon., XI, 1858, *Vulsella*, pl. i, figs. 6, 4 ; pl. ii, fig. 17.
Vulsella vulsella, Dunker, Jahrb. Deutsch. Malakozool., Ges., II, 1875, p. 2.
Vulsella vulsella, Smith, Proc. Malacol. Soc. London, V, 1911, p. 307, pl. xi, figs. 1–3.
Vulsella vulsella, Tomlin, Trans. Linn. Soc. London (Zoology), XXII, 1927, p. 302.
Vulsella vulsella, Thiele, Faun. Sudwest Austral., V, 1930, p. 590.
Vulsella vulsella, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 88.

A single, moderate-sized, spirit specimen from Rameswaram and three fairly large, empty valves from Pamban are represented in the collection. The shell is rather narrow, elongated and slightly arched, but the shape of the outline is somewhat irregular and subject to considerable variation. The valves are somewhat inflated towards the umbonal margin, but flattened towards the ventral extremity. The dorsal margin is usually convexly rounded, but sometimes more or less bluntly angular, and the umbo small, pointed, slightly curved and beak-like. The ligament nodule is very large and rounded and is placed in an oblique, triangularly rounded socket in a special, shelf-like downward prolongation of the hinge plate. The outer surface is roughly concentrically striated. The inner surface is smooth and more or less pearly. The shell is pale brownish, marked with narrow, slightly wavy, longitudinal darker brown bands radiating from the umbo. The present specimens approach very closely Reeve's figure and description of *V. lingulata*, though they are slightly more markedly arched. The largest valve in the collection measures about 70 mm. in length. Pamban and Rameswaram.

Genus **Malleus** Lamarck, 1799.

The shell is narrow and elongated, often with plaited margins and more or less markedly elongated hinge margin. The ligament bears a large nodule as in *Vulsella*. The foot bears a byssus. This genus includes the remarkable hammer oysters.

A single species has been recorded from Pamban.

Malleus malleus (Linné).

Plate VI, fig. 1.

Ostraea malleus, Linné, Syst. Nat., Ed. X, 1758, p. 699.
Ostraea malleus, Born, Ind. Nat. Mus. Caes. Vindobon, 1778.
Malleus vulgaris, Lamarck, Anim. sans vert., 1801, p. 133.
Malleus vulgaris, Blainville, Man. Malacol., 1825, p. 527, pl. lxiii, fig. 4.

Malleus malleus, Gray, Proc. Zool. Soc. London, 1847, p. 199.
Malleus vulgaris, Reeve, Conch. Icon., XI, 1858, *Malleus*, pl. ii, fig. 5.
Malleus vulgaris, Dunker, Cat. Mus. Godeffroy, V, 1874, p. 115.
Malleus vulgaris, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 289.
Malleus vulgaris, Iredale, Proc. Zool. Soc. London, 1914, p. 666.
Malleus vulgaris, Hornell, Common, Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 167.
Malleus malleus, Thiele, Faun. Sudwest Austral., V, 1930, p. 591.
Malleus malleus, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 102.

A few dead shells from Pamban are represented in the collection. The shell is large, very thick, massive, elongated and somewhat irregularly twisted. The hinge margin is greatly produced both anteriorly and posteriorly into long, narrow lobes and the elongated body of the valves extends at right angles to this straight hinge margin, giving the appearance of a hammer, so characteristic of the members of this genus. The valves are rather tortuous and bear an irregularly undulating margin, the depressions in one valve closely interlocking with the corresponding elevations in the other. There is a sort of web-like expanded intervening part connecting the lobes of the hinge with the main, central, narrow part of the valves. The shell is made up of several, superimposed layers of calcareous laminae, and these give the margins of the shell a coarsely plaited appearance. The outer surface is very rough, uneven and irregular, but the inner surface is comparatively smooth and even slightly glossy. The adductor impression is very large, oval and blackish. The shell is of a more or less uniform purplish black colour, both on the inner and outer surfaces. Pamban.

This species is readily distinguished from the common Madras species, *M. albus*, by its very much darker colour and by its surface being much more irregular and contorted.

Family PTERIIDAE.

The hinge margin is straight and toothless, angular or produced behind. The ligament is somewhat sunk, moderately long. The hinge margin bears one or two ill defined tooth-like thickenings beneath the umbo. A concavity for the byssus is present below the anterior angle. The outer surface is often scaly, and the left valve somewhat more strongly inflated than the right. This family includes the well known pearl oysters, wing mussels and their allies.

Two genera, *Pteria* and *Pinctada* are represented at Pamban. Thiele includes *Pinctada* as a sub-section of the genus *Pteria*, but the differences between the two are generically so diagnostic that I have decided to follow Prashad in keeping the two distinct in the present account.

In *Pteria*, which includes the wing mussels, the shell is much longer than high, the outer surface is smooth and not conspicuously scaly and the hind angle is always definitely prolonged, often greatly so. This prolongation often appears as a definite, wing-like

expansion marked off from the rest of the shell by an oblique, elevated area extending from the umbo to the hind lower margin.

In *Pinctada*, on the other hand, which includes the true pearl oysters, the valves are about as high as long and the hind end of the hinge margin, though definitely angular, is produced to a much less extent than in the wing mussels. The outer surface is usually covered with concentric scaly layers.

Genus **Pteria** Scopoli, 1777.

The hind angle is markedly elongated. The shell is longer than high, and the outer surface is generally smooth.

Two species, *P. chinensis* and *P. castanea* have been recorded from the Pamban area. In the latter, the shell is proportionately narrower dorso-ventrally and more elongated transversely, the ventral margin more or less straight and the hind angle of the hinge margin only slightly produced, while in the former the shell is higher and more rounded ventrally and the hind angle of the hinge margin more strongly produced.

Pteria chinensis (Leach).

Plate VI, fig. 2.

Avicula chinensis, Leach, Zool. Miscell., I, p. 86, pl. xxxviii, 1814, fig. 1.
Avicula crocea, Lamarck, Anim. sans vert., VI, 1819, p. 148.
Avicula crocea, Sowerby, Cat. Tankerville, 1825, p. 24.
Avicula crocea, Deshayes, Encyclopédie Méthodique, Vers. II, 1830, pl. 100.
Avicula iridescens, *A. trochilus*, Reeve, Conch. Icon., X, 1858, *Avicula*, pl. xiii, fig. 48 ; pl. xiv fig 51.
Avicula crocea, Chenu, Man. de Conchyl., II, 1862, p. 159, fig. 786.
Avicula crocea, Melvill & Standen, Journ. Linn. Soc. London (Zoology), XXVII, 1899, p. 183.
Avicula iridescens, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 289.
Pteria crocea, Melvill, Trans. Linn. Soc. London (Zoology), XIII, 1909, p. 124.
Avicula radiata, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 166, fig. 40
Pteria chinensis, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, pp. 92 and 93.

Two clusters of shells of this species attached to pieces of a Gorgonian and collected at Rameswaram are represented in the collection. This species is widely distributed in the Indo-Pacific Region, and has also been recorded from the Madras area. The shell is fairly large, very obliquely triangular, somewhat inflated and bears a straight and elongated hinge margin. The umbo is placed far forwards and the umbonal region of the valves is particularly gibbous. The hind angle of the hinge margin is strongly produced into a narrow and elongated process, the hind margin below which is rather deeply sinuated. The surface bears a delicate sculpture of very fine, close-set, undulating, concentric striae which become conspicuously festooned towards the lower margin. The sculpture is particularly well marked in young shells. The posterior elongation grows markedly longer with age.

The colouration is rather variable. The present specimens show gradations between dark chestnut and pale orange-brown. The living shells are frequently found attached to Gorgonian corals by means of their byssus. Rameswaram.

Pteria castanea (Reeve).

Plate VI, figs. 3*a* and 3*b*.

Avicula castanea, Reeve, Conch. Icon., X, 1858, *Avicula*, pl. xiii, fig. 49.
Avicula castanea, Kuster, Conch. Cab., VII, 3, 1869, pl. xxi, fig. 7.
Pteria castanea, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 104.

A single spirit-preserved specimen, with its soft parts intact, from Krusadai Island, is represented in the collection. The shell is moderately large, strongly obliquely triangular and the vertical height is less in proportion to the transverse length than in the preceding species. The surface is very minutely concentrically striated. The wing-like posterior expansion is considerably broader and shorter than in the preceding species. The posterior margin is broadly sinuated beneath the hind prolongation of the hinge margin. The umbo is placed very near the front end, the anterior angle being short, blunt and beak-like. The valves (notably the left) are rather convexly bulged, particularly along an oblique line extending from the umbo down to the hind lower margin. The shell is dark purplish red traversed by blackish brown transverse lines of which those towards the umbo tend to be slightly undulating. Krusadai Island.

Genus **Pinctada** (Bolten) Röding, 1798.

The shell is much less markedly oblique than in the preceding genus. It is almost equivalve and the hind angle is only very slightly produced.

The species of this genus are extremely variable and consequently the synonymies of the various species are very confusing. Jameson in his paper on *The Identity and Distribution of the Mother-of-Pearl Oysters*[1] rightly asserts that " the species of *Pinctada* are difficult to separate from one another by hard and fast lines owing to the absence of well marked diagnostic characters and the extraordinary amount of geographical and casual variation".

Subsequently, however, Prashad and Bhaduri[2] have cleared up mach of the confusion regarding the Indian species, and it is hoped that the following key, though rather artificial, might yet help in some measure in separating the three species recorded from the Pamban area :—

1. Shell generally small. Anterior auricle (prolongation of the hinge margin) well marked. Posterior auricle practically absent. The nacreous

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[1] Proc. Zool. Soc. London, 1901, I, p. 372.
[2] Rec. Ind. Museum, XXXV, 1933, pp. 167—174.

border on the posterior margin extending almost at right angles to the nacreous border of the hinge line .. .. *P. anomioides.*

—Shell definitely larger. Anterior auricle much less strongly developed than the posterior which is prominent and well developed. Posterior border of the nacreous layer forming an acute angle with that of the hinge line 2

2. Hinge entirely toothless and hinge margin only slightly more than half the length of the nacreous area of the valves in the antero-posterior direction. External colour usually dark olive green with radial rows of white or yellowish spots. Margin of nacre dark or smoky .. .. .. *P. margaritifera.*

—Hinge with a small tooth or ridge-like thickening in front of the ligament. Hinge margin broader. External surface of shell generally greyish or pale brown with dark brown or chestnut bands radiating from the umbo. Margin of nacre paler .. *P. vulgaris.*

Pinctada margaritifera (Linné).

Plate VII, figs. 1*a* and 1*b*.

Mytilus margaritifera, Linné, Syst. Nat., Ed. X, 1758, p. 704.
Margarita sinensis, Leach, Zool. Miscell., I, 1814, p. 180, pl. xviii.
Mytilus margaritiferus, Wood, Index Test., 1825, p. 56, pl. xii, fig. 4.
Margaritifera margaritifera, Gray, Proc. Zool. Soc. London, 1847, p. 200.
Avicula cumingii, *A. barbata* and *A. margaritifera*, Reeve, Conch. Icon., X, 1857, *Avicula*, pl. iv, fig. 6, pl. v, fig. 9, pl. viii, fig. 21.
Meleagrina margaritifera, Cooke, Ann. & Mag. Nat. Hist., (5), XVII, 1886, p. 136.
Margaritifera margaritifera, Jameson, Proc. Zool. Soc. London, 1901, p. 373.
Margaritifera margaritifera, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 165.
Pinctada margaritifera, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 98.
Pinctada margaritifera, Prashad and Bhaduri, Rec. Ind. Mus., XXXV, 1933, p. 168.

This species is represented in the Museum collection by a few empty shell valves from the Pamban area. It is fairly common in the Indian waters, but particularly abundant in the Persian Gulf. The shell is larger and more solid on the average than in the next species, *P. vulgaris*, and it may be further distinguished from the latter by the much shorter hinge margin, this being only slightly more than half the maximum length of the nacreous area of the valves and the relatively greater convexity of the valves. Teeth are entirely absent from the hinge margin. The anterior angle of the hinge is clearly marked off from

the body of the shell and projects as a short, but distinct rostrum. It is separated from the lower part of the anterior margin by a deep notch. The concentric laminae on the external surface of the shell are conspicuous though these are generally worn out towards the umbo in dead shells. The surface is brownish green or olive green, ornamented with several indistinct radial rows of white spots. The margin of the nacreous layer is darker, being somewhat dull bluish green in colour, while the non-nacreous border is smoky brown. The muscle scar is characteristically pointed dorsally. Krusadai and Shingle Islands.

Pinctada vulgaris (Schumacher).

Plate VII, figs. 2*a* and 2*b*.

Perlamater vulgaris, Schumacher, Essai Nouv. Syst., 1817, p. 108, pl. xx, figs. 3a and *b*.
Avicula fucata, Gould, Proc. Boston Soc. Nat. Hist., 1850, III, p. 309.
Avicula perviridis, *A. occa*, *A. aerata*, and *A. fucata*, Reeve, Conch. Icon., X, 1857, *Avicula*, pl. viii, figs. 20, 24, pl. x, fig. 32, pl. xvii, fig. 74.
Avicula radiata, Vaillant (nec Deshayes), Journ. de Conchyl., XIII, 1865, 114.
Margaritifera vulgaris, Jameson, Proc. Zool. Soc. London, 1901, p. 384.
Pteria (*Margaritifera*) *vulgaris*, Lynge, Marine Lamellibranciata of the Danish Expedition to Siam, 1909, p. 48.
Margaritifera vulgaris, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 161 and 174.
Pinctada vulgaris, Tomlin, Trans. Zool. Soc. London, XXVI, 1927, p. 301.
Pinctada vulgaris, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, pp. 99 and 100.
Pinctada vulgaris, Prashad and Bhaduri, Rec. Ind. Mus., XXXV, 1933, p. 169.

This species is as widely variable as the preceding one and is equally well represented in the Pamban area. A few dead shells washed up on the Krusadai Beach and some spirit-preserved, mounted specimens with the soft parts intact, are contained in the collection. The shell is larger in average size than in the next species, *P. anomioides*, from which it is further distinguished by the presence of a well marked posterior auricle separated from the lower part of the hind margin of the shell by a deep byssal notch. Externally, the posterior auricle is separated off from the rest of the shell by a ridge-like fold extending dorso-ventrally. The dorso-ventral axis of the shell tends to be slightly oblique, thus approaching the condition seen in *Pteria*. The anterior auricle is very poorly developed, and often practically absent. The valves are convex, the left valve being slightly more so than the right. There are usually one or two small, transversely elongate, ridge-like teeth in front of the ligament. The external surface of the shell is generally covered by concentric laminae which bear, triangular, scaly processes, but the part near the umbo tends to be smoother. The surface is smooth and devoid of laminae in old or worn out specimens. The shell is much paler than in the preceding species. Externally it is greyish white or creamy white with a number of dark reddish brown bands radiating from the umbo. On the interior, the non-nacreous border is rayed with alternate bands of white and brown. Young shells

tend to be more or less squarish in outline, and slightly yellowish externally. This species is the common Indian Pearl Oyster, and is found in great abundance near Tuticorin, in the Gulf of Manaar, and around Ceylon. Krusadai Island.

Pinctada anomioides (Reeve).

Plate VII, figs. 3*a* and 3*b*.

Avicula anomioides, Reeve, Conch. Icon., X, 1857, *Avicula*, pl. ix, fig. 26.
Avicula (*Meleagrina*) *anomioides* (sic) Dunker, in Martini-Chemnitz, Conch. Cab., (N.F.), VII, (3), 1872, *Avicula*, p. 54, pl. xviii, fig. 6.
Margaritifera anomioides, Jameson, Proc. Zool. Soc. London, 1910, p. 384.
Pinctada anomioides, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 100.
Pinctada anomioides, Prashad and Bhaduri, Rec. Ind. Mus., XXXV, 1933, p. 172.

The shell in this species is smaller in average size than in the two preceding species. A single dead shell and four spirit-preserved specimens with the soft parts intact are represented in the collection. There is a well developed anterior auricle, but the posterior edge of the hinge line terminates abruptly, there being hardly any trace of the posterior auricle, and, as mentioned in the diagnostic key above, the posterior nacreous border forms almost a right angle with the hinge line, but the actual non-nacreous posterior edge of the shell slopes somewhat obliquely, forming an obtuse angle with the edge of the hinge line. The right valve is nearly flat, but the left is moderately convex. The outer surface of the shell is almost smooth, but there are a few feebly developed scaly laminae towards the lower margin. The shell is pale yellowish brown externally, but the colour is rather variable. The surface is ornamented with a few broad, greyish black radial bands. The largest specimen in the Museum collection measures 38 mm. high, 37 mm. long and 10 mm. in maximum thickness. Krusadai Island.

Family PINNIDAE.

The shell is large and moderately thin, with a pointed anterior extremity and a terminal umbo situated at this end, gradually widening posteriorly, the hind end being gaping. The ligament is elongated and placed in a groove. The hinge is toothless. The anterior adductor muscle is small, while the posterior is large. The byssus is strongly developed.

This family includes the large, elongately triangular shells commonly known as the feather shells. They are generally firmly rooted in the sand under shallow water, by means of their strong byssus, with only a small portion of the gaping posterior region exposed above the surface of the mud.

The shells are subject to a great deal of variation and the same species often shows different characters in different stages of the growth of the shell. Great care must therefore be taken in the identification of these forms.

This family includes a single genus, *Pinna*.

Genus **Pinna** Linné, 1758.

With the characters of the family.

Three species have been recorded from Pamban. They may be distinguished as follows :—

1. A medial groove present on the inside of each valve extending from the anterior end to the posterior adductor impression. Nacreous layer divided into two parts by the groove	2 (Sub-genus *Pinna s.str.*).
—Shell without medial groove on the inside of each valve or corresponding keel on the outside. Nacreous layer undivided. Shell thicker and darker in colour	*P. vexillum* (Sub-genus *Atrina*).
2. Colour of shell rather variable, generally more or less uniformly pale horny brown. Definite colour markings absent except for the somewhat indistinct blotches of darker brown here and there. Hind margin rather truncated. The two lobes of the nacreous layer parted posteriorly by a narrow area	*P. atropurpurea.*
—Shell pale brown with very distinct radial blackish brown bands radiating from the umbo. Hind margin somewhat more rounded. The two lobes of the nacreous layer parted posteriorly by a much wider area	*P. bicolor.*

Sub-genus **Pinna** s.str.

Shell valves with an internal, medial longitudinal groove.

Pinna atropurpurea Sowerby.

Plate VIII, fig. 1.

Pinna atropurpurea, Sowerby, Cat. Tankerville, Appendix, 1825, p. 5.

Pinna atropurpurea, Hanley, Cat. Recent Bivalve Shells, 1843, p. 255.

Pinna trigonium, Dunker, Zeitschr. Malakozool., IX, 1852, p. 60.

Pinna philippinensis, P. electrina, P. zebulensis, P. fumata, P. madida, P. mutica, P. euglypta, P. atropurpurea, P. vespertina, P. virgata, (non Menke), *P. augustana* and *P. regia*, Reeve, Conch. Icon., XI, 1858, *Pinna*, pl. xi, fig. 20 ; pl. xiv, figs. 25, 26 ; pl. xv, fig. 27 ; pl. xvii, fig. 31 ; pl. xviii, fig. 34 ; pl. xx, fig. 37 ; pl. xxii, fig. 41 ; pl. xxiii, fig. 44 ; pl. xxiv, fig. 45 ; pl. xxvii, fig. 51 ; pl. xxx, fig. 56.

Pinna regia, Hanley, Proc. Zool. Soc. London, 1858, p. 227.
Pinna aequilatera, von Martens (nec Weinkauff), Mobius Beitrage Meeresf. Mauritius, Seychelles, 1880, p. 317, pl. xxii, fig. 4.
Pinna mutica, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 53.
Pinna atropurpurea, Winckworth, Proc. Malacol. Soc. London, XVIII, 1929, p. 283.
Pinna atropurpurea, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 133.

This is the commonest species of *Pinna* recorded from the Pamban area. Living specimens are particularly common on the mud flats at Kungudal Point where several large specimens have been collected. They are also frequently found at Rameswaram whence a giant shell is represented in the Museum collection. The shell is subject to considerable variation, both in form and colour, and this has been partly responsible for the numerous synonymous names by which this species had been known by various authors. The shell is elongately triangular with the posterior margin more or less squarely truncated. Some shells have both the dorsal and ventral margins almost straight, while in others the dorsal margin is slightly concave. The shell bears feebly developed radial ribs separated by rather wide interstices. In dead shells the ventral margin is always found slightly gaping. The width of the posterior margin is about half the length of the ventral or dorsal margin. The colour is variable and shows gradations between a dark purplish brown and a pale horny brown. Some shells are variously rayed or banded with dark brown. The shells are nearly smooth in adult specimens. Living specimens are rooted firmly to their sandy substratum by means of their byssus. Kundugal Point, Pulli Reef and Rameswaram.

Pinna bicolor Gmelin.

Plate VIII, fig. 2.

Pinna bicolor, Gmelin, Syst. Nat., Ed. XIII, 1791, p. 3366.
Pinna dolobrata, Lamarck, Anim. sans vert., VI (i), 1819, p. 133.
Pinna dolobrata, Lamarck, Anim. sans vert., Ed. II, Vol. VII, 1836, p. 65.
Pinna bicolor, Hanley, Cat. Recent Bivalve Shells, 1843, p. 255.
Pinna bicolor, Reeve, Conch. Icon., XI, 1858, *Pinna*, pl. ix, fig. 17.
Pinna bicolor, Odhner, K. Sv. Vet. Arkiv. Biol., XII, 1919, No. 6, p. 3, pl. i, fig. 1.
Pinna bicolor, Hornell, "Common Molluscs of South India, Mad. Fish. Bull., XIV, 1922, p. 176.
Pinna bicolor, Winckworth, Proc. Malacol. Soc. London, XVIII, 1929, p. 286.

This species is much less common than the preceding and only a single specimen from Pamban is represented in the Museum collection, but Mr. Winckworth reports that it is a common shell on the pearl banks of Manaar and that it has been taken at "Kutikal with the starfish *Pentaceros herdmanni*." The shell is much less variable than that of the preceding species. It resembles the latter in its general shape and proportions and in the presence of a medial groove on the inside of each valve from the umbo to the posterior adductor scar, but is readily distinguished from it by the presence of numerous broad, conspicuous, blackish brown bands radiating from the umbo to the hind margin. It is

also a thicker and coarser shell with a more copious deposit of nacre and a more highly polished interior. The two lobes into which the nacre is divided is parted by a wider area posteriorly than in the preceding species. The adult shell bears a few feebly developed, smooth radial ribs, but in the young shell these ribs are almost always more pronounced and strongly scaly. The hind margin is evenly rounded. This species is widely distributed in the Indo-Pacific Region. Kundugal Point and Pamban.

Sub-genus **Atrina** Gray, 1842.

Shell valves without an internal medial groove.

Pinna vexillum Born.

Plate VIII, fig. 3.

Pinna vexillum, Born, Test. Mus. Caes. Vindobon, 1780, p. 134, pl. vii, fig. 8.
Pinna exusta, Gmelin, Syst. Nat., Ed. XIII, 1791, p. 3366.
Pinna rudis and *P. gubernaculum*, Röding, Mus. Boltenianum, 1798, p. 159.
Pinna nigra, Dillwyn, Descr. Cat., I, 1817, p. 325.
Pinna nigrina, Lamarck, Anim. sans vert., VI, 1819, p. 134.
Pinna vexillum, *P. nigra* and *P. adusta*, Hanley, Cat. Recent Bivalve Shells, 1843, p. 254.
Pinna nigra and *P. vexillum*, Reeve, Conch. Icon., XI, 1858, *Pinna*, pl. iii, fig. 4 ; pl. xix. fig. 36.
Pinna nigrina and *P. vexillum*, von Martens, Journ. Linn. Soc. London (Zoology), XXI, 1886, p. 204.
Pinna nigra, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Pinna nigra, Odhner, K. Sv. Vet. Arkiv. Biol., XII, 1919, No. 6, p. 3.
Pinna (Atrina) vexillum, Winckworth, Proc. Malacol. Soc. London, XVIII, 1929, p. 287.
Pinna (Atrina) vexillum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 135.

A few broken fragments of shells and some entire shells from the beach on Krusadai and Shingle Islands are represented in the Museum collection. The shell is without the medial groove inside the valves, so characteristic of the two preceding species, and is proportionately much less elongate and considerably broader. It is also much thicker and darker, often almost blackish in colour, hence the synonymous specific name, *nigra*. The outer surface of the shell bears very feebly developed and rather irregularly disposed radiating ribs which may either be smooth or bear erect, recurved, scaly processes, the species being rather variable in this respect. In most of the specimens examined, the entire valve bears definite indications of the presence of scales, of which those towards the posterior margin persist almost entirely, while those on the rest of the surface are found to be worn away to a varying extent. The hinge margin is almost straight, while the ventral margin is broadly expanded posteriorly. The interior of the valves is highly glossy and the nacre is well developed. The shell is of a dark, almost blackish brown colour, which is intensified towards the umbonal area. The dark colour of the shell is reported by Mr. Winckworth to be a reliable specific character. Krusadai and Shingle Islands.

SERIES PECTINACEA.

Family PECTINIDAE.

The shell is of variable shape and size, usually inequivalve, and often with radial ribs or folds. The hinge margin is moderately long, without true hinge teeth, sometimes with diverging lamellar or stout anterior and posterior teeth. The anterior adductor muscle is wanting. The ligament often bears a triangular and medial nodule placed in a groove. The shell is usually brightly coloured. This family includes the scallops and their allies.

This family is represented at Krusadai by three genera, *Plicatula*, *Pecten* and *Spondylus*, each belonging to a separate sub-family.

1. Shell perfectly regular, evenly rounded, with distinct, uniformly developed radial ribs. Valves free, not attached to any substratum. Hinge margin rather long with well-developed auricles. Hinge entirely toothless. Animals generally possessing the power of swimming .. .. *Pecten.*

—Shell more or less irregular and unevenly rounded. Usually with broad, rather irregularly developed radial folds, or even rows of spiny processes. Shell attached to some substratum by the right valve. Hinge short, auricles less prominent or absent. Hinge with two stout articulating teeth in each valve. Animals sedentary 2

2. Surface of shell thrown into radial folds. Hinge margin short, without anterior angle. Shell as a rule dull-coloured, more or less whitish .. .. *Plicatula.*

—Surface of shell generally decorated with radial rows of spiny processes on the free left valve, while the attached right valve is crudely concentrically laminated. Anterior angle of hinge margin more or less well defined. Shell as a rule bright pinkish or deep brick-red in colour.. .. *Spondylus.*

Sub-family PLICATULINAE.

Shell somewhat irregularly shaped, usually with radial folds, with the right valve attached. The hinge margin is short and without the anterior angle, but always with two stout teeth in each valve.

Genus **Plicatula** Lamarck, 1801.

With the characters of the sub-family.

A single species has been recorded from Pamban.

Plicatula australis Lamarck.

Plate VIII, fig. 4.

Plicatula australis, Lamarck, Anim. sans vert., VI, 1819, p. 185.
Plicatula australis, Sowerby, Thes. Conchyl., I, 1847, p. 436; pl. xci, figs. 20–22.
Plicatula australis, Hanley, Cat. Recent Bivalve Shells, 1856, pp. 288 and 289; pl. xxiv, fig. 44.
Plicatula multiplicata, Deshayes, Cat. Moll. Reunion, 1863, p. 33, pl. xxxii, figs. 5 and 6.
Plicatula australis, Sowerby, in Reeve, Conch. Icon., XIX, 1873, *Plicatula*, pl. iii, figs. 10*a*, *c–e*.
Plicatula australis, Lamy, Bull. Mus. d' Hist. Nat. Paris, XXIV, 1918, p. 513.
Plicatula australis, Dautzenberg, Moll. test. mar. Madagascar, 1929, p. 558.
Plicatula australis, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 115.
Plicatula australis, Lamy, Journ. de Conchyl., LXXXIII, 1939, p. 14.

This species is subject to a great deal of variation, and Lynge[1] considers that it is probably synonymous with *Plicatula imbricata* Menke, but Lamy (*loc. cit.*) states that it is a distinct species and regards *P. multiplicata* Deshayes as a synonym for *P. australis*, Lamarck. This species is represented in the Museum collection by a few specimens collected alive from the reefs. It is a moderately small, flattened, oyster-like shell with a somewhat irregular outline and a rough exterior. The valves are roughly ovate, or elongately roundish and rather depressed, but the left unattached valve is slightly more convex than the attached right valve. The hinge bears two strong teeth in each valve as in *Spondylus*, but they are comparatively small and slender in the present species. The ligamentary nodule is small and situated centrally. The auricles are rudimentary, and, if developed at all, lie within the general contour of the shell. The pallial impression is distinct. The single adductor muscle impression is relatively large, circular and placed slightly posteriorly. The right valve is attached and shows no particular form of sculpture. The left valve is more convex and bears on its outer surface a number of irregularly radiating folds which are often interrupted here and there. The interior is smooth, white and glossy. The outer surface is whitish or pale yellowish brown with numerous black dots scattered all over the surface. Shingle Island.

Sub-family PECTININAE.

Genus **Pecten** (Klein) Osbeck, 1765.

The shell is rounded, usually with strong radial ribs. The auricles are distinctly developed. The valves are generally rather flat, but sometimes more or less inflated.

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[1] Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 56.

Four species of *Pecten* are known from Krusadai. They may be distinguished as follows :—

1. Valves finely radiately striated throughout. In addition to this fine sculpture, the valves are thrown into five to seven, broadly rounded, raised radial ribs with broad interstices between them .. *P. plica.*

—Surface of valves not finely striated, but with more numerous and narrower radiating ribs which are separated by narrower and more sharply defined interstices 2

2. Shell occasionally with a uniformly yellowish, but usually with a very well defined pattern of reddish brown or chestnut patches on a white ground. Colour bands often in the form of widely spread out V's. Ribs rather smooth .. *P. tranquebaricus.*

—Colour pattern much less sharply defined. Shell reddish or pinkish, with irregular white blotches. Ribs rougher and relatively less widely separated. 3

3. Shell just about as high as long. Ribs not very rough and without spiny processes. Shell somewhat thicker and valves rather convex. Interstices between the ribs deep .. .. .. *P. crassicostatus.*

—Shell definitely higher than long. Radial ribs on surface very rough and bearing spiny processes (especially when fresh and towards the margin). Shell slightly thinner and less markedly convex. Interstices between the ribs shallower, the ribs being consequently less sharply separated .. .. *P. splendidulus.*

Pecten tranquebaricus (Gmelin).

Plate VIII, figs. 5*a* and 5*b*.

Ostraea tranquebarica, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3328.
Pecten tranquebaricus, Sowerby, Thes. Conchyl., I, 1842, pl. xii, figs. 12 and 13.
Pecten tranquebaricus, Catlow & Reeve, Conch. Nomencl., 1845, p. 84.
Pecten tranquebaricus, Reeve, Conch. Icon., VIII, 1855, *Pecten*, pl. iii, fig. 14.
Pecten tranquebaricus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 39.

This is by far the commonest species of scallop collected on South Indian shores, and quite a large number of shells, both from Madras and from Krusadai, are represented in the Museum collection. The shell is subject to considerable variation in colour and colour pattern, but the Pamban shells in the collection are usually white, with well defined, broad, reddish brown or chestnut transverse bands, typically in the form of broadly expanded, V-shaped markings with the apices of the V's pointing towards the umbo, but frequently these bands lose their distinctness and become more irregular in shape tending to cohere here and there. The valves are rounded and equilateral, but the auricles are rather markedly unequal, the anterior auricle being much longer than the posterior. The radial ribs on the surface are strongly developed. The upper surfaces of these ribs are smooth, but their sides are finely serrated. The ribs are sharply separated by deeply excavated interstices. Only empty valves are represented in the collection. Pamban and Krusadai Island.

Pecten splendidulus Sowerby.

Plate IX, figs. 1*a* and 1*b*.

Pecten splendidulus, Sowerby, Thes. Conchyl., I, 1842, p. 76, pl. xx, fig. 246.
Pecten splendidulus, Catlow & Reeve, Conch. Nomencl., 1845, p. 83.
Pecten splendidulus, Reeve, Conch. Icon., VIII, 1855, *Pecten*, pl. xix, fig. 67.
Pecten splendidulus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 39.

This species may be readily distinguished from the remaining three species by the shell being definitely higher than long. The outline of the shell is more or less triangularly ovate and rather angulated at the sides. The auricles are unequal as in the preceding species, but the hind upper angle of the posterior auricle is obtuse. The ribs are rounded, more numerous, more closely set and less sharply separated from each other than in the preceding species. They bear numerous spine-like scales which are particularly conspicuous towards the margin. The right valve is slightly more strongly flattened than the left. The shell is deep reddish or pinkish, with small whitish blotches and specks scattered all over, especially over the auricles. This species is considerably rarer than the preceding at Krusadai, and is represented by a few dead shells from Pamban, both in the original Museum collection and in Mr. Crichton's collection. Pamban.

Pecten crassicostatus Sowerby.

Plate IX, figs. 2*a* and 2*b*.

Pecten crassicostatus, Sowerby, Thes. Conchyl., I, 1842, p. 75, pl. xv, fig. 111 ; pl. xvii, fig. 152.
Pecten crassicostatus, Sowerby, Proc. Zool. Soc. London, 1842, p. 164.
Pecten crassicostatus, Catlow & Reeve, Conch. Nomencl., 1845, p. 80.
Pecten crassicostatus, Reeve, Conch. Icon., VIII, 1855, *Pecten*, pl. xviii, fig. 64.

Pecten crassicostatus, Paetel, Catal. Conch. Samml., III, 1890, p. 229.
Pecten crassicostatus, Melvill & Standen, Moll. of Torres Straits, Journ. Linn. Soc. London, XXVII, 1899, p. 183.
Pecten senatorius, (?) Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 57.
Pecten senatorius, (?) Dautzenberg & Bavay, Siboga-Expeditie, Lamellibranches, Monogr. LIIIB, 1912, p. 4.
Pecten crassicostatus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 39.

Dautzenberg and Bavay (*loc. cit.*) regard *Pecten crassicostatus* Sowerby as a synonym of *P. senatorius*, and Dr. Gravely suggests (*loc. cit.*) that in view of the great colour variation presented by the species, *P. splendidulus* may also be similarly regarded. The shell of *P. crassicostatus* attains a rather large size. It is slightly thicker, broader, more perfectly circular in outline and more convex than that of *P. splendidulus*, but resembles the latter somewhat in its colouration. The valves are equilateral, rounded and about as high as long. The right valve is considerably more flattened than the left. The auricles are unequal, the hind one being shorter and sloping posteriorly. The ribs are more numerous than in *P. tranquebaricus* and less sharply separated from each other. The surfaces of the ribs bear faint transverse curved striations throughout their length. Most of the ribs also bear one or two faint longitudinal grooves on the surface so that the ribs appear composite. The interstices are shallow and about as broad as the ribs themselves. The outer surface is bright reddish brown, marked all over with irregular white spots and blotches. The interior is glossy, whitish and smooth for the most part, but towards the periphery there is a broad marginal fleshy pink band, this part being conspicuously cut up into broad, flattened, tooth-like ridges by deep grooves which correspond in position with the external ribs. This species is rare at Pamban, whence a single fine shell measuring 63 mm. high and of about the same length is represented in the Museum collection. Pamban.

Pecten plica (Linné).

Plate IX, figs. 3*a* and 3*b*.

Ostraea plica, Linné, Syst. Nat., Ed. X, 1758, p. 697, No. 162.
Ostraea plica, Linné, ibid., Ed. XII, 1767, p. 1145, No. 192.
Pecten plica, Catlow & Reeve, Conch. Nomencl., 1845, p. 82.
Pecten plica, Reeve, Conch. Icon., VIII, 1855, *Pecten*, pl. iii, fig. 16.
Pecten plicatus, Chemnitz, Conch. Cab., VII, 1784, p. 292, pl. 62, fig. 598.
Pecten plica, Martini-Chemnitz, Conch. Cab., VII, 2 Abth., 1843, pp. 53 and 96; pl. xiv, figs. 3 and 4; pl. xxvi, fig. 4.
Pecten (*Pallium*) *plica*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 60.
Pecten plica, Dautzenberg & Bavay, Siboga-Expeditie, Lamellibranches, Monogr. LIII B, 1912, p. 27.

This species is the rarest of the four Pamban species of *Pecten* and may at once be distinguished from the rest by its peculiar form of sculpture. The shell is moderately small and triangularly ovate, being slightly higher than long. The surface is uniformly traversed throughout by fine, close-set radial grooves and in addition to this delicate grooved sculpture, the valves bear a few (usually from five to seven) widely separated, raised and broadly

rounded radial ribs. The ribs at the extreme sides of the shell generally tend to be more closely spaced than the median ones. The ribs of the left valve are more rounded and more strongly raised than those of the right, with deeper and broader interstices between them. The auricles are small and nearly equal in size. On the inner surface of the valves, which is whitish and tinged with brown, the position of each external radial rib is indicated by a pair of sharp ridge-like teeth marking its boundaries, these thickenings being particularly well marked towards the margin. The right and left valves differ markedly in thier colouration. The left valve is orange-red with whitish patches especially near the margin. The right valve is almost completely white except for the fine reddish stippling on the ribs and a few irregular reddish specks towards the margin. Pamban.

Sub-family SPONDYLINAE.

The shell is inequivalve, attached by the right valve, and, as a rule with strong folds or spiny processes. The ligamentary area of the right valve is larger than that of the left and with a median nodule. The hinge margin always bears two stout teeth and corresponding grooves.

Genus **Spondylus** Linné, 1758.

With the characters of the sub-family.

The genus *Spondylus* is represented at Pamban by two species, *S. layardi* and *S. imperialis*. The latter is much rarer and may be readily distinguished from the former by the presence of about six radial rows of remarkably long, very strong, stiff, pointed spines, the intervening spaces between these rows being occupied by numerous close-set rows of minute spines.

Spondylus layardi Reeve.

Plate IX, figs. 4*a* and 4*b*.

Spondylus layardi, Reeve, Conch. Icon., IX, 1856, *Spondylus*, pl. xviii, fig. 66.
Spondylus layardi, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 56.
Spondylus layardi, Fulton, Journ. of Conchology, XIV, 1915, p. 354.
Spondylus layardi, Lamy, Bull. Mus. d'Hist. Nat. Paris, XXXIII, 1927, p. 303.
Spondylus layardi, Lamy, Journ. de Conchyl., LXXXII, 1938, p. 205.
Spondylus layardi, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 152.

This species is very well represented on Indian shores, and has been recorded from Madras, Tuticorin and Pamban. Dead shells are moderately plentiful on the beaches on Krusadai, Shingle and Pullivasal Islands. It is a large, thick, somewhat irregular shell with a roughly ovate outline. The outer surface is very rough and irregular. The animal lives attached by the right valve to some suitable substratum, and not infrequently empty

valves are found attached to pieces of dead sponges washed up on the beach. The left valve bears on the exterior a number of irregularly radiating rows of strong, often large and flattened, spine-like processes, while the right valve is ornamented with rough, concentric, overlapping laminae. The hinge bears two very stout, protruding teeth in each valve which interlock strongly and effectively with two corresponding sockets in the opposite valve. In the closed condition, the teeth of the right valve lie between the teeth of the left valve which are farther apart. The ligament is triangular and situated centrally. The degree of convexity of the valves is subject to considerable variation. The outer surface is bright purplish pink (often fading into a dull fleshy white in worn shells, while the inner surface is smooth, glossy and white throughout except for a narrow strip along the margin all round which is pinkish, and the hinge area which is pale fleshy or smoky brown. The shells taken on the beach are often more or less worn, with most of the spines rubbed away and the colour faded. Pamban, Kundugal Point, Krusadai, Pullivasal and Shingle Islands.

Spondylus imperialis Chenu.

Plate X, fig, 1.

Spondylus imperialis, Chenu, Illustr. Conch., 1843, p. 6, pl. xxvi, figs. 2 and 3.
Spondylus imperialis, Sowerby, Thes. Conchyl., I, 1847, p. 424, pl. lxxxviii, figs. 43–45.
Spondylus imperialis, Hanley, Cat. Recent Bivalve Shells, 1856, p. 291.
Spondylus imperialis, Reeve, Conch. Icon., IX, 1856, *Spondylus*, pl. viii, fig. 28.
Spondylus imperialis, Smith, Fauna and Geography of the Maldive and Laccadive Archipelagoes, II, 1903-p. 621.
Spondylus imperialis, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 288.
Spondylus imperialis, Fulton, Journ. of Conchology, XIV, 1915, p. 335.
Spondylus imperialis, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 113.
Spondylus imperialis, Lamy, Journ. de Conchyl., LXXXII, 1938, p. 297.

This species is represented in Mr. Crichton's duplicate collection by a single, entire specimen with both the valves intact and labelled "near Pamban, procured from the Madras Fisheries Department". The shell is much more regular than that of *S. layardi* and the valves are slightly more flattened, and more or less equal in size (i.e., nearly equivalve). Dorsally, the front and hind margins of the shell converge rather narrowly towards the hinge while ventrally, the edges of the valves are evenly rounded, but some of the extreme ventral spines project a considerable distance beyond the general level of the edge of the ventral margin. The shell bears a characteristic and strongly developed sculpture consisting of six, widely spaced, thick, radial ribs carrying long, downwardly directed, strong, stiff spines, and three finer and weaker interestitial ribs in each of the interspaces between the main ribs, bearing much smaller, weaker and finer spines set almost perpendicular to the surface of the shell. These interestitial ribs and the spaces between them are uniformly grooved

radially. The spines are longer ventrally than towards the umbo. The auricles are short, but well developed. The teeth on the hinge are disposed in the same manner as in *S. layardi*, but are relatively small. The inner surface of the shell is smooth, pinkish white and glossy, the positions of the main as well as the secondary external ribs being indicated by pure white radial lines. The margin of the inner surface is toothed. The radial ribbing gives the edge of the valves a strongly undulating appearance in an end-view. The outer surface is of a pale pink colour. Pamban.

Family LIMIDAE.

The shell is colourless, higher than long, usually ovate, and either straight or oblique, more or less inflated and either completely closing or gaping. The outer surface bears stronger or finer radial ribs or folds which are often nodular or transversely scaly. The umbo is placed medially above the triangular ligamentary area. The hinge margin is either smooth or toothed.

This family includes a single genus, *Lima*, which is represented at Pamban by a single species, *L. lima*.

Genus **Lima** Chemnitz, 1784.

With the characters of the family.

Lima lima (Linné).

Plate X, figs. *2a* and *2b*.

Ostraea lima, Linné, Syst. Nat., Ed. X, 1758, p. 699.
Ostraea lima, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3332.
Lima squamosa, Sowerby, Cat. Tankerville, 1825, p. 24.
Ostraea lima, Wood, Index Test., 1825, p. 51, pl. xi, fig. 54.
Lima squamosa, Catlow & Reeve, Conch. Nomencl., 1845, p. 80.
Lima squamosa, Vaillant, Journ. de Conchyl., XIII, 1865, p. 112.
Radula lima, Angas, Proc. Zool. Soc. London, 1865, p. 656.
Lima squamosa, Sowerby in Reeve, Conch. Icon., XVIII, *Lima*, 1872, pl. ii, fig. 10.
Lima squamosa, Melvill & Standen, Journ. Linn. Soc. London (Zoology), XXVII, 1899, p. 182.
Lima lima, Hedley, Proc. Linn. Soc. N.S. Wales, XXXI, 1906, p. 646.
Lima lima, Lamy, Journ. de Conchyl., 1930, LXXIV, p. 95.
Lima (*Lima*) *lima*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 119.
Lima lima, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 41.

This species is widely distributed in the Indo-Pacific Region and has also been recorded from Madras and Ceylon. The shell is white, obliquely ovate and about one and a half times as high as long. The anterior side is straight, obliquely produced and somewhat flattened. The region next in front of the umbo is concavely depressed and forms a well marked lunule. The posterior margin of the shell is rounded, but rather indented immediately below the posterior auricle. The longest dorso-ventral axis of the shell runs obliquely from the umbo and is nearer to the anterior margin than to the posteror. The surface bears numerous strong, close-set radial ribs ranging from about 22 to 25 or even more, and separated

by deeply incised grooves. Each of these ribs often bears a series of strong, sharply raised, triangular or oblong, recurved, scale-like processes which are large and pronounced towards the ventral margin, but small and sometimes almost entirely rubbed away towards the umbo. The auricles are short and slope down obliquely from the umbo. The ligament is located on a semicircular ledge projecting inwards from the umbonal angle. Young shells are more flattened and relatively thin. The shell is uniformly whitish throughout. A few dead shells including a young specimen are represented in the Museum collection. Pamban.

SERIES ANOMIACEA.

Family ANOMIIDAE.

The shell is usually irregularly rounded, often thin and translucent, smooth or sculptured. The inner surface is usually pearly. The right valve bears a deep byssal cleft in the young shell, which in the adult either closes up to form a circular perforation (*Anomia*) or else disappears completely with the byssus (*Placenta*).

Only a single genus, *Placenta*, is represented at Pamban.

Genus **Placenta** Retzius, 1788.

The shell is strongly laterally compressed, the valves being very much flattened and disc-like. The shell is often large, more or less thin and translucent. The young shell is attached by a byssus, but the adult is unattached without any trace of the byssus or the byssal cleft. The outer surface is very finely radially striated.

A single species, *Placenta placenta*, is recorded from Pamban.

Placenta placenta (Linné).

Plate X, fig. 3.

Anomia placenta, Linné, Syst. Nat., Ed. X, 1758, p. 703.
Placenta orbicularis, Retzius, Diss. sist. nova testaceorum genera, Lund., 1788, p. 15.
Placuna placenta, Lamarck, Anim. sans vert., VI, 1819, p. 224, No. 3, Ed. 2, Vol. VII, p. 270, No. 3.
Placuna placenta, Martini-Chemnitz, Conch. Cab., VII, 1 Abth., 1843, p. 66, pl. v, fig. 3.
Placuna placenta, Reeve, Conch. Icon., XVIII, 1873, *Placuna*, pl. iii and iv, figs. 3 *a–d*.
Placuna placenta, Fischer, P. Cat., de Moll. de l' Indo-Chine, 1891, p. 208.
Placuna placenta, Hornell, Rep. Ceylon Mar. Biolog. Laboratory, I, pt. 2, 1906, p. 41.
Placenta orbicularis, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 793.
Placuna placenta, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 11.
Placuna placenta, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 153.
Placenta placenta, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 41.

This is the common window-pane oyster of the Indian shores and is known also from the Madras area. A few large empty valves from Pamban are represented in the Museum collection. The shell is large, very flat, thin rounded and translucent, with a characteristic

brittle texture. The valves are rather fragile and are seldom found entire at the edges where they thin out considerably. The inner surface is smooth, glossy and displays a brilliant pearly iridescence. The adductor impression occurs at about the centre of the valve as a well defined reniform mark. The umbo is small and inconspicuous. There are two thin, ridge-like teeth diverging from the umbo at a rather narrow angle. These teeth are unequal in length, the posterior being the longer. The outer surface is rendered slightly rough by the presence of a very fine sculpture consisting of minute radial striae. The shell is uniform whitish and attains a large size being often as much as four to six inches in diameter, or even more. This species is widely distributed in the Indo-Pacific Region, and in China the shells are used for making window panes. Kundugal Point and Pamban.

SERIES OSTRACEA.

Family OSTREIDAE.

The shell is inequivalve, and more or less irregular, with the left valve firmly attached to some substratum. The ligament nodule is located in a triangular groove. The hinge margin is toothless. The margin of the shell is not infrequently more or less strongly folded. The foot and byssus are rudimentary. This family comprises the true oysters, which are included under the single genus, *Ostrea*.

Genus **Ostrea** Linné, 1758.

With the characters of the family.

Four species of oysters have been recorded from the Pamban area. They may be distinguished as follows :—

1. Valves thrown into more or less well defined radial folds, those of the two valves interlocking with each other. Shell generally not much longer than high 2

— Valves not thrown into radial folds. Right valve more or less flattened. Left valve much deeper and convex. Margins of the valves presenting an even appearance, without interlocking folds. Shell generally rather elongate. Ligamentary socket also elongated .. .. *O. madrasensis.*

2. Shell rather transversely elongate, and adhering to twigs of mangrove. Upper valve raised longitudinally along the middle into a broadly rounded, rib-like thickening .. .. *O. folium.*

— Shell not as above, more varied in shape, generally attached to rocks 3

3. Radial folds very strong, deep, angular, and extending more or less throughout the length of the valves. Margin cut up into very deep, sharp and angular teeth-like points, which interlock deeply into corresponding depressions in the opposite valve . . . . *O. crista-galli.*

— Radial folds less strongly developed, relatively shallow, rather broadly rounded, and more or less confined to the margins and their immediate vicinity. Margins of the valves presenting an undulating appearance, and interlocking not so deeply as in the above . . . . *O. forskalii.*

Ostrea forskalii Gmelin.

Plate X, figs. 4*a* to *e*.

Ostrea cucullata, Born, Testacea Mus. Caes. Vindobon, 1780, p. 114, pl. vi.
Ostrea forskalii, Chemnitz, Conch. Cab., VIII, 1785, p. 30, pl. 72, fig. 671.
Ostrea cucullata, Reeve, Conch. Icon., XVIII, 1873, *Ostrea*, pl. xvi, fig. 34.
Ostrea cucullata var. *forskalii*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, pp. 64 and 65.
Ostrea cucullata, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 169 and 175, fig. 42.
Ostrea forskalii, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 41.

This is by far the commonest species of oyster occurring in the Pamban area. It is the common rock oyster of the Indian shores, and is equally well represented at Madras. Living specimens may be found in large numbers attached to the huge blocks of stone and the massive stone pillars beneath the Pamban Bridge and also to coral stones on the reefs adjoining Krusadai and Shingle Islands. This species exhibits a very wide range of variation in form and size, the shape being as a rule very irregular and the radial folds show all gradations between slight undulations of the margin to very deep and well-defined plaits. The left valve which is attached to the substratum is thick and larger than the right which covers it as a comparatively shallow lid. The attached valve may sometimes be flattened, or in the form of a shallow cup but not infrequently it assumes the form of a very deep and capacious cup, its shape being determined to a large extent by the nature of the surface of attachment. The margin of the valves is thrown into a series of folds which are sometimes more or less extended radially and those of the two valves interlock with each other firmly. There is a single large adductor impression in the centre of the valves. The left valve usually extends a little beyond the right at the margins. The outer surface of the

right valve bears concentric imbricating plaits towards the margin. The valves are whitish or greyish white, boldly marked with deep purple towards the margin, particularly so on the inner surface. Pamban, Krusadai and Shingle Islands.

Ostrea madrasensis Preston.

Plate X, fig. 1.

Ostrea madrasensis, Preston, Rec. Ind. Mus., XII, 1916, pp. 33–35 ; figs. 11 and 11 *a*.
Ostrea virginiana, (non Röding), Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 158, 159 and 169.
Ostrea madrasensis, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1. 1941, p. 41.

This species, which has been recorded earlier by Dr. Gravely (*loc. cit.*) from the Ennur backwaters in the Madras area, is represented in the collection by a few dead shells from the Pamban area as well. It resembles *Ostrea rostrata* to a certain extent, but differs from it in the shell being straighter, and in having the hinge groove not so narrow and elongated as figured by Reeve (Conch. Icon., XVIII, 1873, *Ostrea*, pl. vi, fig. 9*a*). Preston also compares this species to *O. canadensis* Lamarck (which Reeve cites as a synonym for *O. rostrata* Chemnitz), and points out that the present species differs from it in having a straighter form and thinner texture and in being much more foliaceous externally. The outer surface of the valves is covered with intensely foliaceous laminae, which closely overlap. The hinge area is narrow, elongate and produced to a point and accommodates an elongately triangular groove which is transversely striated. The left valve is much deeper than the right. The inner surfaces of the valves are smooth, glossy and whitish, but the edges and the conspicuous reniform adductor impression are of a deep purplish black colour ; the colour of the muscular impression, however, is much deeper than that of the edges, and sometimes almost approximates to a jet black. The shell attains a fairly large size, the largest valve in the collection measuring 130 mm. long and 85 mm. broad. The margins of the valves are not thrown into folds as in the previous species. Only dead shells have yet been collected. Krusadai and Shingle Islands.

Ostrea crista-galli (Linné).

Plate XI, figs. 2*a* and 2*b*.

Mytilus crista-galli, Linné, Syst. Nat., Ed. X, 1758, p. 704.
Ostrea crista-galli, Lamarck, Anim. sans vert., VI, 1819, p. 213.
Ostrea crista-galli, Sowerby, Cat. Tankerville, 1825, p. 27.
Mya crista-galli, Gray, Proc. Zool. Soc. London, 1847, p. 201.
Ostrea crista-galli, Sowerby, in Reeve, Conch. Icon., XVIII, 1873, *Ostrea*, pl. xi, figs. 22 a—c.
Ostrea crista-galli, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 179.
Ostrea (*Lopha*) *crista-galli*, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 288.
Ostrea crista-galli, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 176.
Ostrea crista-galli, Lamy, Journ. de Conchyl., LXXIII, 1929, p. 254.
Ostrea (*Lopha*) *crista-galli*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 131.

This is the well known 'cock's comb oyster' which has been doubtfully recorded from the Madras area by Dr. Gravely. It is a very well defined species of *Ostrea* and is easily distinguished from the allied forms by the characteristic shape of the valves. It is widely distributed in the Indo-Pacific Region, but only a single entire, mounted shell from Pamban is represented in the Museum collection. The shell is broadly rounded, or more or less subquadrate in outline and the valves are thrown into very strong, radial folds which are exceptionally deep and sharply angular. The margins of the valves are consequently cut up into very strong, angular, projecting, sharply pointed teeth-like processes which interlock very firmly and effectively with the [correspondingly deep depressions in the opposite valve. The outer surface of the folds are characteristically sculptured with diverging, close-set, granulated striae. The colour is rather variable, ranging from brownish to a pale violet. The present specimen is dark brownish externally, while the smooth and slightly glossy interior is pale greyish white. These oysters are commonly attached to Madreporite corals in groups by means of lobed processes of the shell. The edge of the inner surface of the shell bears a series of fine, rounded granules. The single Pamban specimen in the collection measures 65 mm. long and 47 mm. wide. Pamban.

Ostrea folium Gmelin.

Plate XI fig. 3.

Ostrea folium, Gmelin, Syst. Nat., Ed. XIII, 1791, p. 3334, No. 103.
Ostrea folium, Chemnitz, Conch. Cab., V, 1781, p. 8, pl. vii, figs. 662 and 666.
Ostrea folium, Catlow & Reeve, Conch. Nomencl., 1845, p. 86.
Ostrea folium, Reeve, Conch. Icon., XVIII, 1873, *Ostrea*, pl. xviii, fig. 40.

A single specimen from Pamban, attached to a piece of mangrove twig, is represented in the Museum collection. This species is peculiar in that the shell is almost always found attached firmly to stems of mangroves. The shell is more or less elongated and broadly ovate in outline. The left valve is deeply concavely excavated along the middle so as to fit the surface of attachment, and also develops special elongated lobes so as to render the attachment firm and effective. The right (i.e., the unattached) valve is raised into a characteristic, broadly rounded, tube-like, longitudinal rib along the middle corresponding to the excavation of the left valve. On either side of this medial, rib-like elevation the shell is thrown into numerous, rounded folds which diverge away from the middle line. The surface is more or less smooth, except for a few thin, overlapping laminae towards the margin. The shell is of a pale brownish purple colour throughout. In the single specimen in the collection both valves are intact and firmly closed, and the shell measures 45 mm. long and 30 mm. broad at the middle where it is widest. This species is popularly known as the 'leaf oyster' and is comparatively rare. Pamban.

Order Eulamellibranchiata.

Sub-Order Heterodonta.

SERIES ASTARTACEA.

Family CRASSATELLIDAE.

The shell is moderate-sized, usually thick, ovate, or with the hind margin somewhat beaked, and often concentrically grooved. The umbo is angular, and the ligament internal. The left valve bears two hinge teeth between which fits the cardinal tooth of the right valve, and a weak tooth in front and a rudimentary one behind. The lateral teeth are scarcely developed. The pallial line is non-sinuate.

The genus *Crassatella* is represented at Pamban by a single species.

Genus **Crasstella** Lamarck, (1799) 1801.

The shell is inequilateral, generally longer than high, ovate, or with the hind margin either truncated or beaked. The cardinal teeth are more or less distinct, the left valve bearing one anterior and two posterior and the right two anterior and one posterior tooth. The lateral teeth are hardly developed.

Crasatella rostrata Lamarck.

Plate XI, figs. *4a* and *4b*.

Crassatella rostrata, Lamarck, Ann. du Mus., VI, 1805, p. 408.
Crassatella rostrata, Lamarck, Anim. sans vert., V, 1818, p. 482.
Mactra rostrata, Bory De Saint-Vincent, Encyclopédie Méthodique, Vers. 1824, p. 151.
Crassatella rostrata, Sowerby, Genera of Shells, 1830, *Crassatella*, pl. i, fig. 3.
Crassatella rostrata, Reeve, Proc. Zool. Soc. London, 1842, p. 44.
Crassatella rostrata, Hanley, Cat. Recent Bivalve Shells, 1842, p. 36, pl. ix, fig. 31.
Crassatella rostrata, Reeve, Conch. Icon., I, 1843, *Crassatella*, pl. ii, fig. 10.
Crassatella rostrata, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 191.
Crassatella rostrata, Lamy, Bull. Mus. d' Hist. Nat. Paris, XIX, 1913, p. 104.
Crassatella rostrata, Lamy, Journ. de Conchyl., LXII, 1914, p. 221.

A single shell from Pamban with both the valves intact is represented in the Museum collection. The shell is thick, triangularly ovate, being definitely longer than high, rounded anteriorly and somewhat produced and more or less sharply angular and beak-like posteriorly. The surface of the shell is practically smooth, except for a small portion adjoining the umbo which bears a few well marked and close-set concentric ridges. The surface is covered throughout with a thin, rather glossy, yellowish brown periostracum and is traversed by a number of radial lines of a paler tint diverging from the umbo to the ventral margin. The arrangement of the hinge teeth is as stated above in the description of the genus. The

impressions of the adductor muscles are very distinct and even slightly depressed. The pallial line is not sinuate. The interior of the shell is smooth, glossy and whitish, and its margin is strongly toothed, these teeth being very small and close-set towards the anterior and posterior margins, particularly near the latter. Reeve has recorded this species from Ceylon. Pamban.

SERIES CARDITACEA.

Family CARDITIDAE.

The shell is usually moderate-sized, solid and thick, obliquely ovate or elongate, with strong radial ridges and sometimes with a strongly projecting umbo. The ligament is as a rule external. The cardinal teeth are almost always grooved so as to form one small anterior, and on the left valve one and on the right two strongly elongate, oblique, posterior teeth. The anterior teeth as well as the laterals tend to be rudimentary.

This family, comprising the so called false cockles, resemble the true cockles (*Cardium*) in general appearance, but differ from them in being inequilateral and in having the hinge teeth developed unequally in the two valves.

Two genera, *Cardita* and *Beguina* are represented at Pamban. The latter may be readily distinguished from the former by the shell being much longer in proportion to the height, in having an almost terminal umbo situated close to the anterior end, and in the posterior adductor impression being markedly larger than the anterior.

Genus **Cardita** Bruguière, 1792.

The shell is thick, inflated, usually rounded or ovate, with a raised umbo situated near the middle. The anterior cardinal teeth are more or less suppressed. The adductor impressions are not much unlike in size.

A single species, *Cardita bicolor*, which is also the sole representative of this genus in the Madras area, has been recorded from Pamban.

Cardita bicolor Lamarck.

Plate XI, figs. 5*a* and 5*b*.

Cardita bicolor, Lamarck, Anim. sans vert., VI, 1819, p. 23.
Cardita bicolor, Hanley, Cat. Recent Bivalve Shells, 1843, p. 145.
Cardita antiquata (pars), Reeve, Conch. Icon., I, 1843, *Cardita*, pl. vi, fig. 29 *b*.
Actinobolus antiquatus, Adams, H & A., Genera of Recent Mollusca, II, 1857, p. 48.
Cardita bicolor, Chenu, Man. de Conchyl., II, 1862, p. 135, fig. 643.
Venericardia antiquata, Smith, E. A., (non Linné), Proc. Zool. Soc. London, 1891, p. 429.
Cardita antiquata, Melvill & Standen (non Linné), Proc. Zool. Soc. London, 1906, p. 812.
Venericardia bicolor, Lamy, Bull. Mus. d' Hist. Nat. Paris, XXII, 1916, p. 57.
Venericardia (Cardites) bicolor, Lamy, Journ. de Conchyl., LXVI, 1921, p. 320, pl. viii, figs. 1 and 2.
Cardita bicolor, Hornell, Common Molluscs of South India, Mad. Fish Bull., XIV, 1921, p. 177.

The shell is thick, solid and ovate, and bears a superficial resemblance to a *Cardium*. The valves are fairly deep and somewhat oblique, i.e., the longest dorso-ventral axis of the shell runs obliquely from the umbo to the ventral margin. The umbo is rather conspicuously curved anteriorly. There are two elongated posterior teeth extending from the umbo and separated from each other by a deep groove. The anterior tooth is minute and sometimes almost absent. The shell is sculptured with very strong radial ribs, the ribs being thick and well raised, with flattened surfaces. The anterior ribs are usually transversely tuberculated while the median and posterior ones are smooth. The interstices between the ribs are deep. The shell is white, marked with brownish or bright orange spots which are mainly confined to the surfaces of the ribs, and tend to be larger anteriorly. In fresh shells there is a thin, tawny brown periostracum. The inner surface is white and its margin appears strongly toothed owing to the presence of the external radial ribs. This species is well represented in the Pamban area but only dead shells have yet been collected. Kundugal Point, Pamban, Krusadai and Shingle Islands.

Genus **Beguina** (Bolten) Röding, 1798.

(Syn. **Trapezium** Mus. Calonn. 1797).

The shell is more or less elongated, ribbed, with the umbo placed very close to the anterior end. The posterior cardinal teeth are elongated. The posterior adductor impression is larger than the anterior.

Two species, *B. variegata* and *B. crassicosta* have been recorded from Pamban. Of these, the former, which is much commoner, is represented in the Madras area as well, and can be readily distinguished from the latter by the valves being relatively higher in proportion to the length, and by the less pronounced development of the curved, scale-like processes on the ribs.

Beguina variegata (Bruguière).

Plate XI, figs. 6*a* and 6*b*.

Cardita variegata, Bruguière, Encyclopédie Méthodique, Vers. I, 1792, p. 402, pt. 229, fig. 6.
Cardita calyculata, Lamarck, (non Linné), Anim. sans vert., VI, 1819, p. 24.
Cardita calyculata, Sowerby, Genera of Shells, 1822, *Cardita*, pl. i, figs. 1 and 2.
Cardita variegata, Reeve, Conch. Icon., I, 1843, *Cardita*, pl. i, fig. 3.
Actinobolus variegata, Mac Andrew, Ann. & Mag. Nat. Hist., Ser. 4, VI, 1870, p. 448.
Cardita variegata, von Martens, Journ. Linn. Soc. London (Zoology), XXI, 1887, p. 208.
Mytilicardia variegata, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 814.
Cardita variegata, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 67.
Cardita variegata, Lamy, Journ. de Conchyl., LXVI, 1921, p. 244.
Cardita (*Arcinella*) *variegata*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 142.
Beguina variegata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 44.

Dead shells of this species are not uncommon on the Krusadai beach. The shell is somewhat thick, solid, rather strongly inflated and oblong in outline, with a terminal umbo situated at the front end. The front margin of the shell is slightly indented, the lower margin straight and the dorsal and hind margins more or less evenly rounded. The shell is sculptured with broad, strongly developed ribs radiating from the umbo. These ribs bear on their surfaces numerous overlapping scaly processes, which are small and close-set on the anterior ribs, but become larger and more widely spaced on the comparatively stout posterior ribs. The interstices between the ribs are narrow and traversed by fine transverse striae. The arrangement of the hinge teeth is much the same as in *Cardita bicolor*, except that the anterior tooth is inclined to be less rudimentary. On the inner surface, the pallial line and the adductor impressions are indicated by well marked depressions and the margin appears strongly undulated owing to the presence of the strong external ribs. The shell is dull whitish, marked, particularly over the ribs, with brownish, crescent-shaped spots. Pamban and Krusadai Island.

Beguina crassicosta (Lamarck).

Plate XI, figs. 7*a* and 7*b*.

Cardita crassicosta, Lamarck, Anim. sans vert., VI, 1819, p. 24 (non *Venericardia crassicosta*, Sowerby).
Cardita squamifera, Sowerby, Cat. Tankerville, 1825, p. 18.
Cardita crassicosta Hanley, Cat. Recent Bivalve Shells, 1843. p. 146.
Cardita crassicosta, Reeve, Conch. Icon., I, 1843, *Cardita*, pl. ii, figs. 7 *a*, *b* and *d*.
Mytilicardia crassicosta, Angas, Proc. Zool. Soc. London, 1865, p. 652.
Cardita crassicosta, Verco, Trans. Roy. Soc. South Australia, XXXVI, 1912, p. 205.
Cardita crassicosta, Lamy, Bull. Mus. d' Hist. Nat. Paris, XXII, 1916, p. 114.
Cardita crassicosta, Lamy, Journ. de Conchyl., LXVI, 1921, p. 241, pl. vii, figs. 11, 12 and 13.

This species is considerably rarer than the preceding one and is represented in the Museum collection by a single dead shell from Pamban. The shell is proportionately narrower and more elongated transversely than in *B. variegata*. The umbo is more or less terminal, being situated almost at the anterior end. The short, truncated, anterior margin of the shell is definitely narrower than the comparatively broadly rounded hind margin. The dorsal margin is somewhat convex about the middle, while the lower margin is slightly concave ; this gives the shell a more or less markedly arched appearance. The oblique radiating ribs on the surface are relatively few and somewhat more widely spaced than in the preceding species, but the scaly processes on the ribs are much larger, more conspicuously raised and strongly curved, their concavities facing away from the umbo. The posterior ribs are much stronger and broader than the rest. The scales towards the posterior margin are larger and more markedly erect than those on the rest of the surface. The interstices between the ribs are not very deeply excavated. The single empty shell in the Museum collection is somewhat worn. It is of a dirty white colour externally, but indistinct,

pale brownish patches are present towards the margin. The interior is smooth, white and distinctly rayed with two or three purplish brown streaks. Pamban.

SERIES LUCINACEA.

Family LUCINIDAE.[1]

The shell is of variable size, equivalve, rounded or obliquely ovate, smooth or with distinct concentric and sometimes also radial sculpture. The umbones are small and placed close together. The lunule is usually small, depressed and asymmetrical. The hinge teeth are often reduced. The ligament is elongated and marginal, with a nodule. The anterior muscle scar is long and narrow and is continuous with the pallial line.

This family which includes the bladder shells, is represented in the Pamban area by four genera which may be distinguished with the aid of the following key :—

1. Shell very thick, elongately and somewhat obliquely ovate, usually with strong concentric lamellae. Margin of the valves denticulated	*Corbis.*
— Shell not as above, much thinner and more perfectly rounded, almost regularly circular in outline. Sculpture as a rule weaker. Margin of the valves smooth	2
2. Hinge toothless. Shell valves strongly inflated. Shell generally smooth or sculpture consisting at most of concentric striae only	*Lucina.*
— Hinge with two cardinal teeth and lateral teeth either wanting or variable in number. Shell valves less strongly inflated and sculpture stronger and more varied	3
3. Shell valves only slightly inflated and shell consequently appearing lens-shaped. Sculpture consisting of both radial and concentric ridges, the radial generally predominating over the concentric	*Codakia.*
— Shell valves more convex, the shell being consequently more markedly inflated. Sculpture consisting of characteristic, raised, divaricating ridges	*Divaricella.*

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[1] The genus *Corbis*, which is represented at Krusadai and is characterized by a thick, obliquely ovate shell, is treated under a separate family, Corbidae, by Pelseneer, but in this paper I have followed Thiele, who includes is in the Lucinidae.

Genus **Lucina** Lamarck, 1799.

The shell is more or less large, moderately thin, rounded, inflated, smooth or concentrically striated, without dorsal area. The umbo is placed slightly in front of the middle. The ligament is sunk in an oblique furrow. The hinge is toothless.

Four species of *Lucina* have been recorded from Krusadai Island. They may be distinguished as follows :—

1. Surface of shell without any form of sculpture, except for growth striae 2

— Shell small, solid, convex, with very thick, strong, concentric ridges, the interstices between which are traversed by close-set, finer radiating ridges .. *L. pisum.*

2. Shell small, thin and rather fragile ; dorsal margin of shell behind the umbo more or less obliquely inclining and hind upper angle of hinge margin not sharply marked, but more or less evenly rounded. *L. vesicula.*

— Shell larger, thicker and more solid ; dorsal margin of shell behind the umbo nearly straight and more or less perfectly horizontal and hind upper angle of hinge margin rather sharply marked 3

3. Shell large, thick and very strongly inflated. Surface with pronounced development of raised growth striae. Dorsal margin of shell prolonged considerably in front of the umbo and hence front angle of upper margin more or less distinct and sharply marked. Hinge thick and strong .. *L. edentula.*

— Shell slightly smaller in average size, not quite so thick and slightly less strongly inflated. Surface of shell smoother, the growth lines being weaker and much less conspicuous. Front angle of upper margin of shell not very prominent owing to the very slight prolongation of the dorsal margin in front of the umbo. Hinge thinner and finer .. *L. ovum.*

Lucina edentula (Linné).

Plate XII, figs. 1*a* and 1*b*.

***Venus edentula*, Linné, Syst. Nat., Ed. X, 1758, p. 689, No. 122.**
***Lucina edentula*, Philippi, Zeitschr. Malakozool., II, 1845, p. 179.**

Lucina philippiana and *L. pila*, Reeve, Conch. Icon., VI, 1850, *Lucina*, pl. v, figs. 21, 24 and 25.
Loripes Philippiana, Tryon, Proc. Acad. Nat. Sci. Philadelphia, XXIV, 1872, p. 90.
Lucina edentula, Dunker, Index Moll. Mar. Japonicum, 1882, p. 216, pl. viii, figs. 7 and 8.
Lucina (*Anodontina*) *edentula*, von Martens, Journ. Linn. Soc., London (Zoology), XXI, 1887, p. 173.
Azinus globosus, Sowerby, (non Forskal), Journ. de Conchyl., VI, 1889, p. 157.
Lucina (*Thyasira*) *edentula*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 71.
Lucina edentula, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 154.
Lucina edentula, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 45.

This species is widely distributed in the Indo-Pacific Region, and is well represented at Krusadai, as well as at Madras. Dead shells of this species are frequently found washed up on the beach on Krusadai Island. The shell is white, fair-sized, with moderately convex valves. The valves are somewhat thin and more or less perfectly rounded in outline and the concentric growth lines on the surface are very conspicuous. The dorsal margin of the shell extends horizontally a little distance in front of the umbo, and the angle at which it meets the front margin is more distinct and sharply defined than in the next species. Posteriorly, the dorsal margin slopes and gradually rounds off into the hind margin without forming a distinct angle as on the anterior side. The umbo is small, pointed and inclined anteriorly. The depression for the attachment of the ligament is shallow and not well marked. In addition to the concentric growth striae, very fine, radial grooves can be made out with the aid of a lens especially towards the margin. A particularly large right valve in the collection from Krusadai Island measures 65 mm. long, 58 mm. high and 22 mm. deep, but the shells are generally smaller in average size. This species has been shown to be synonymous with Reeve's *L. philippiana* and *L. pila*, while *L. edentula* of Reeve has been later correctly identified as *L. chrysotoma*. Krusadai Island.

Lucina ovum Reeve.

Plate XII, figs. 2*a* and 2*b*.

Lucina ovum, Reeve, Conch. Icon., VI, 1850, *Lucina*, pl. v, fig. 21.
Loripes ovum, Angas, Proc. Zool. Soc. London, 1867, p. 926.
Lucina (*Thyasira*) *ovum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 72.
Lucina ovum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 15.
Lucina ovum, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 45.

The shell is smaller and the valves are relatively more convex than in *L. edentula*. The surface of the shell is much smoother, the growth lines being much less conspicuous. The dorsal margin of the shell in front of the umbo is much shorter and rounds off into the front margin, the front angle being consequently much less prominent than in the preceding species. The umbo is inclined anteriorly and the narrow, elongated depression, extending posteriorly from the umbo, for the attachment of the hinge ligament is much deeper here, and is present as a well-marked groove. The valves collected are somewhat bleached but many of them bear an yellowish tinge which is characteristic of this species. On examining

a series of valves of this species it is readily observed that the smaller valves (measuring from about 12 mm. to 24 mm. in length) are on the whole relatively much deeper (the depth being about half the length) than the larger ones measuring from about 30 mm. to 38 mm. in length, the depth of the valves in these specimens being only about one-third their length, as in *L. edentula* (see measurement above). Shell valves of *L. ovum* are moderately abundant on the Krusadai beach. Krusadai Island.

Lucina pisum Reeve.

Plate XII, figs. 3*a* and 3*b*.

Lucina pisum, Reeve, Conch. Icon., VI, 1850, *Lucina*, pl. xi, fig. 66.
Lucina (*Codakia*) *pisum*, Reeve, in Smith, " Challenger ", Zoology, XIII, 1885, Lamellibranchiata, p. 181.
Parvilucina eucosmia, Dall, Synopsis of the Lucinaceae, 1901, p. 806.
Lucina (*Phacoides*) *pisum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 76.
Lucina (*Cyclas*) *semperiana*,[1] Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 815.
Phacoides (*Bellucina*) *semperianus*,[1] Lamy, Journ. de Coenhyl., LXV, 1920, p. 211.
Lucina pisum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 163.

This species is characterized by a small, solid shell of a nearly globular shape, the valves being rather deeply convex. Reeve describes it aptly as " a small, solid species about the size and form of a pea." The dorsal margin in front of the umbo is distinctly depressed, and rounds off into the front margin. Posteriorly a deep radial groove running near the hind margin marks off an elevated portion of the surface which forms a well-marked, oval, raised area when the two valves are in apposition. The hind margin of this area appears slightly indented in a side view. The outer surface of the shell is very strongly sculptured with thick, raised, concentric ridges, the interstices between which are traversed by finer radial ridges, thus giving the surface a latticed appearance. The minute spaces between the radial ridges appear as fine pits under the lens. The inner surface is smooth, except at the margin, where it is finely toothed. The lunule in front of the umbo is small, heart-shaped and deeply excavated. The shell is generally whitish, but a few specimens in the Museum collection bear a pale brownish tinge. Pamban.

Lucina vesicula Gould.

Plate XII, fig. 4.

Lucina vesicula, Gould, Proc. Boston Soc. Nat. Hist., III, 1850, p. 256,—Expedition Shells, p. 82.
Cryptodon vesicula, Thurston, Rameswaram Island and Fauna of the Gulf of Manaar, 2nd edition, 1895, p. 129.
Lucina (*Thyasira*) *vesicula*, Lynge, Marine Lamellibranchiata of the Danish Expediton to Siam, 1909, p. 73.
Lucina vesicula, Lamy, Journ. de Conchyl., LXV, 1920, p. 83.
Cryptodon vesicula, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 177.

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[1] Prashad is of opinion that *Lucina semperiana* is a distinct species.

This species is represented in the Museum collection by a single spirit-preserved specimen, collected by Dr. Gravely from a piece of coral rock at Pamban and identified for us by Mr. R. Winckworth. The shell is much smaller than that of the preceding species, and the valves are thin and proportionately less convex. The umbo is not appreciably inclined. Both the anterior and posterior portions of the dorsal margin slope obliquely from the umbo, but there is a slight depression of the dorsal margin immediately in front of the umbo. The surface of the shell is smooth, but fine growth lines may be clearly made out, particularly towards the ventral margin. The shell is covered by a yellowish brown periostracum. The shell is of a pale bluish white colour. The measurements of the single shell in the collection are as follows ; height, 10 mm., length, 11 mm., depth of each valve, 3 mm. This species has been previously recorded from the Gulf of Manaar by Dr. Thurston (*loc. cit.*). Pamban and Gulf of Manaar.

Genus **Divaricella** Martens, 1880.

The shell is colourless, rounded, more or less strongly inflated, with a raised, divaricating, ridged sculpture. The lunule is small, deeply depressed. The hinge margin always bears two cardinal teeth and a somewhat varied number of lateral teeth.

A single species, *Divaricella cumingii*, is represented among the Krusadai collection of bivalves.

Divaricella cumingii (A. Adams & Angas).

Plate XII, figs. *5a* and *5b*.

Lucina (Cyclas) cumingii, Adams & Angas, Proc. Zool. Soc. London, 1865, p. 651.
Lucina divaricata, Hutton (non Lamarck), Cat. Mar. Moll, New Zealand, 1873, p. 74.
Lucina divaricata, Hutton (non Lamarck), Journ. de Conchyl., XXVI, 1878, p. 5.
Lucina (Divaricella) cumingii, Smith, " Challenger ", Zoology, XIII, 1885, Lamellibranchiata, p. 177.
Lucina dentata, Hutton (non Wood), Proc. Linn. Soc. N. S. Wales, IX, 1885, p. 525.
Divaricella cumingii, Lamy, Journ. de Conchyl., LXV, 1921, p. 277.
Lucina cumingii, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 177.
Divaricella cumingii, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 161.

The shell of this species is readily distinguished from those of the preceding species of Lucinidae by its well marked and characteristic pattern of sculpture which consists of numerous, flattened, obliquely radiating ridges shaped like inverted 'V's, their limbs being unequal and asymmetrically arranged, those lying towards the anterior side being much shorter than those lying posteriorly, and their apices being arranged on an oblique line running from the umbo down to the front end of the lower margin of the shell. These ridges are slightly curved, the concavity of the curves facing upwards. In addition to this elegant pattern of sculpture, growth lines are present in the form of fine, thread-like, widely spaced, concentric striae, some of which are more strongly developed than the others. The

dorsal margin of the shell in front of the umbo is slightly depressed, but does not form a prominent front angle with the anterior margin. The outline of the front, hind and lower margins of the shell is almost perfectly circular. The inner surfaces of the valves are smooth, except at the margins where they are slightly crenated. The cavity for attachment of the ligament is well developed. Pamban.

Genus **Codakia** Scopoli, 1777.

(Syn. **Lentillaria** Schumacher, 1817).

The shell is varied in size, rounded, lens-shaped and its outer surface bears radial and concentric sculpture. The inner surface is often coloured and without dorsal ridges. The umbo is depressed anteriorly. The hinge usually bears two cardinal teeth. The lateral teeth may be wanting.

Two species of this genus have been recorded from Krusadai Island. They may be distinguished as follows :—

Shell small, rather thin, rounded, nearly equilateral. Dorsal margin in front of the umbo distinctly and sharply excavated. The sculpture is weak, the radiating ribs divaricating anteriorly .. .. *C. angela.*

— Shell larger, thicker, slightly inequilateral. Dorsal margin in front of the umbo not distinct from the front margin, the one leading obliquely and imperceptibly into the other. Sculpture stronger, consisting of radiating ribs which divaricate both near the anterior and posterior margins .. .. *C. divergens.*

Both species are fairly common at Krusadai. *C. divergens* is represented in the collection only by dead shells, but *C. angela* has been collected alive on the reefs.

Codakia angela (Melvill).

Plate XII, figs. 6*a* and 6*b*.

Lucina (Codakia) angela, Melvill, Ann. & Mag. Nat. Hist., (7), IV, 1899, p. 98, pl. ii, fig. 8.
Lucina (Codakia) angela, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 815.
Codakia angela, Lamy, Journ. de Conchyl., LXV, 1920, pp. 115 and 258 (foot-note).
Codakia angela, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 45.

This species is well represented also in the Madras area. The shell is small, thin, white, rounded and nearly equilateral. The sculpture is rather weak, consisting of faint radiating ribs and still fainter concentric striae. The umbo is slightly inclined towards the anterior side. In front of the umbo, the dorsal margin is slightly depressed and forms

a prominent angle where it meets the rounded front margin. Behind the umbo, the dorsal margin slopes and merges into the hind margin without forming an angle. Beyond the middle and towards the anterior side, the radiating ribs divaricate. The ribs are weak, finely transversely striated and are sometimes difficult to make out in the central part of the surface of the shell. The concentric striations are very faint, but can be made out as fine, thread-like lines throughout the surface of the valves. The inner surfaces of the valves are smooth, glossy and white, but their margins are finely toothed in correspondence with the terminations of the radial sculpture on the outer surface. There are two cardinal teeth and two lateral teeth in each valve. The shell impressions are very conspicuous. Krusadai Island.

Codakia divergens (Philippi).

Plate XII, figs. 7*a* and 7*b*.

Lucina divergens, Philippi, Abbild. Beschreib. Conch., III, 1850, p. 103, *Lucina*, pl. ii, fig. 4.

Lucina fibula, Reeve, Conch. Icon., VI, 1850, *Lucina*, pl. vii, figs. 37 and 38.

Lucina fibula, Adams & Reeve, Zoology of the Voyage of H.M.S. "Samarang", Mollusca, 1848, p. 80, pl. xxiv, fig. 5.

Lucina (Codakia) divergens, Dunker, Index Moll. Mar. Japonicum, 1882, p. 216.

Lucina fibula, Cooke, Ann. & Mag. Nat. Hist., (5), XVIII, 1886, p. 99.

Lucina (Codakia) fibula, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 815.

Lucina (Codakia) divergens, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 74.

Codakia (Jagonia) divergens, Lamy, Journ. de Conchyl., LXV, 1920, p. 254.

Codakia divergens, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 157.

This species is widely distributed in the Indo-Pacific Region and Lynge (*loc. cit.*) has given a detailed list of localities from which it has been recorded. Dall considers *Lucina bella* Conard as a synonym for *Codakia divergens* (Philippi), but Prashad disagrees with this view, as the former has been recorded only from San Diego, California. The shell is larger and thicker than in *Codakia angela*, and bears a more strongly developed sculpture, the radial sculpture predominating over the concentric. The shell is not quite so regularly rounded as in *C. angela*, being slightly inequilateral in the present species. The longest dorso-ventral axis of the shell runs rather obliquely, meeting the ventral margin of the shell somewhat anteriorly, and not in the middle. The valves are not very convex, and are much more flattened than in any of the remaining Krusadai species of Lucinidae. The radiating ribs are numerous, well marked and close-set and bear bluntly rounded surfaces traversed by fine, concentric grooves which give the surface a reticulated appearance on close examination. The radiating ribs are separated by narrow grooves and they divaricate towards the anterior and posterior ends. Growth lines are conspicuous. They may be seen as strongly impressed concentric grooves rather widely separated from each other. The umbo is pointed and inclined anteriorly, and the dorsal margin slopes down from it both anteriorly and posteriorly rounding off into the front and hind margins respectively,

without forming any angle. The dorsal margin in front of the umbo, however, is slightly depressed. The hinge teeth are well developed. The interior of the shell is smooth and the margin is not toothed. Most of the shells collected are white, but a few bear a faint yellowish tint on the outer surface. This is one of the commonest bivalves washed up on the Krusadai beach. Krusadai Island.

Genus **Corbis** Cuvier, 1817.

The shell is very thick, solid, elongately ovate, inflated with strong concentric lamellae and fine radial striae in the interstices and with a more or less regularly denticulated margin. The umbo is nearly central and strongly inclined forwards. The hinge always carries two cardinal teeth and anterior and posterior lateral teeth. The pallial line is not sinuate. The foot is long and pointed.

This genus is represented in the Museum collection by only a single Pamban species, *Corbis sowerbyi*, of which a few young shells have been collected from the Pamban area.

Corbis sowerbyi Reeve.

Plate XII, figs. 8*a* and 8*b*.

Corbis sowerbyi, Reeve, Proc. Zool. Soc. London, 1841, pp. 85–87.
Corbis sowerbyi, Catlow & Reeve, Conch., Nomencl., 1845, p. 26.
Corbis sowerbyi, Reeve, Conch. Icon., XVIII, 1873, *Corbis*, pl. *i*, fig. 2.

The shell is moderately thick, oblong-ovate and slightly inequilateral, the umbo being placed a little nearer the front than the hind margin. It is somewhat compressed, but the fully grown shell is more strongly inflated. The surface of the shell is sculptured with strong, raised, concentric lamellae which are more or less markedly crested towards the posterior margin. The wide interstices between the ridges are finely radiately striated. The shells represented in the Museum collection appear rather worn and whitish, but faint indications of the original reddish radial bands which are characteristic of young shells can be detected on the surface in the present specimens. The inner surface is dull white and slightly glossy. Pamban.

SERIES ERYCINACEA.

Family ERYCINIDAE.

(= GALEOMMIDAE).

The shell is generally thin and fragile, gaping ventrally, and the mantle more or less completely reflected over the shell, but is capable of being completely withdrawn into the shell. The shell is usually longer than high and is provided with an internal ligamentary nodule and distinct hinge teeth. The foot is well developed and generally bears a byssus in the hind portion. This family includes forms which possess the power of swimming.

Two genera, *Galeomma* and *Scintilla* are represented at Krusadai. The former may be distinguished from the latter by the presence of a large, azygos anterior tentacle projecting from the mantle, by the hinge being toothless, by the shell being sculptured and by the ventral gape of the shell being wider and more pronounced.

Genus **Galeomma** Turton, 1825.

The shell is transversely elongated, gaping ventrally. The nodule of the ligament is placed in a medial pit. The hinge is feebly developed and is often toothless. The mantle is incompletely reflected over the shell. The foot bears a small, posterior byssal groove. The pallial line is simple.

Only a single species, *Galeomma paucistriata*, has yet been recorded from the Pamban area.

Galeomma paucistriata Deshayes.

Plate XII, fig. 9.

Galeomma paucistriata, Deshayes, Proc. Zool. Soc. London, 1855, p. 170.
Galeomma paucistriata, Sowerby, Thesaurus Conchyl., III, 1862, p. 174, pl. 234, fig. 9.
Galeomma paucistriata, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Galeomma*, pl. i, fig. 2.
Galeomma paucistriata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V., No. 1, 1941, p. 27 (foot-note).

This species is fairly common at Krusadai, and a good number of living specimens have been collected on the reefs adjoining the Island. Dr. Gravely (*loc. cit.*) has described the mode of swimming of this and the succeeding species, and I have carefully verified his comments by my own personal observation. The animals are pale yellowish white, with moderately elongate, ovate shells, very widely gaping ventrally and covered over for the most part by the reflected mantle. They are usually found alive in crevices of coral rock and stones attached by a byssus and lying with their valves widely gaping and their dorsal margin uppermost. The surface of the mantle is roughened by minute, tubercle-like prominences. At each end of the animal, the mantle is prolonged into three tentacle-like processes which are characteristically coloured dark brown at their free, pointed tips. Of these the two lateral ones arise from near the middle of the respective margins of each valve, while the middle one arises from the region of the hinge. The foot is large, laterally compressed, and bears a byssiferous groove at its posterior part. The shell is moderately thin, translucent white, and very finely radiately striated. A few concentric growth lines are also clearly visible. The ventral margin of the valves is very slightly indented in the middle. The hinge is toothless and the pallial line non-sinuate. Krusadai and Shingle Islands.

Genus **Scintilla** Deshayes, 1885.

The shell is more or less gaping ventrally, but to a much less extent than in *Galeomma*. The hinge teeth are feebly developed. Usually the left valve bears two anterior and one posterior tooth, while the right valve bears one or two small anterior and one posterior tooth. The foot is large, with a small, posterior byssal groove.

Three species of this genus are represented in the Krusadai collection of bivalves. They may be distinguished as follows :—

1. Shell somewhat squarish, compressed, closed, or only very slightly gaping ventrally. Mantle covered with a number of small processes	*S. timorensis*.
— Shell with a more rounded outline, more markedly inflated, and more widely gaping ventrally. Mantle practically smooth	2
2. Shell only slightly longer than high. Posterior margin slightly narrower than the anterior. Both anterior and posterior margins rounded	*S. candida*.
— Shell relatively more elongate. Both the anterior and posterior margins equally wide. Posterior margin evenly rounded. Anterior margin somewhat obliquely truncated. Shell with a comparatively wider ventral gape	*S. hanleyi*.

Scintilla hanleyi Deshayes.

Plate XII, fig. 10.

Scintilla hanleyi, Deshayes, Proc. Zool. Soc. London, 1855, p. 180.
Scintilla hanleyi, Sowerby, Thes. Conchyl., III, 1862, sp. 33, figs. 22, 27 and 28.
Scintilla hanleyi, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Scintilla*, pl. ii, fig. 12.
Scintilla hanleyi, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 178, fig. 44.
Scintilla hanleyi, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 27 (foot-note).

This species is moderately common at Krusadai, and numerous living specimens, found in the crevices or attached to the surface of pieces of dead coral stones on the reefs in association with those of *Galeomma paucistriata*, have been collected. The shell is very thin, fragile and translucent white, with a smooth, unsculptured surface. It is elongately ovate and inequilateral, the anterior side being the shorter. As in the preceding species the shell is partially covered by the reflected mantle, but to a considerably less extent, and the anterior and posterior processes of the mantle are much shorter, less conspicuous and not tipped with dark brown as in the preceding species. These processes are often badly contracted in specimens preserved in alcohol. The surface of the mantle is practically smooth, lacking the characteristic granulation seen in the preceding species. The shell is considerably less

elongate than in *Galeomma paucistriata*, and the ventral gape of the valves, though rather pronounced, is not so wide as in that species. The posterior margin is evenly rounded, but the anterior margin is slightly obliquely truncated. If living specimens of this and the preceding species are placed in a bowl of clean sea water, the manner of their swimming may be readily observed. Krusadai, Pullivasal and Shingle Islands.

Scintilla candida Deshayes.

Scintilla candida, Deshayes, Proc. Zool. Soc. London, 1855, p. 177.
Scintilla candida, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Scintilla*, pl. i, fig. 6.

This and the succeeding species are comparatively rare at Krusadai, and are represented in the Museum collection mostly by dead shells. The shell is thin, whitish and much less elongate than that of the preceding species. The surface is smooth and glossy. The outline of the shell is evenly rounded and the posterior margin is slightly narrower than the anterior. The ventral gape is considerably much less than in *S. hanleyi*. The mantle is practically smooth. In the few spirit-preserved specimens of this species represented in the Museum collection, the processes of the mantle are badly contracted and difficult to make out. The foot is pointed and sometimes slightly curved at the tip. Krusadai Island and Pamban.

Scintilla timorensis Deshayes.

Scintilla timorensis, Deshayes, Proc. Zool. Soc. London, 1855, p. 174.
Scintilla timorensis, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Scintilla*, pl. ii, fig. 14.

The shell is very thin, translucent, and bears a smooth and highly glossy surface. It is rather compressed and the valves are almost completely closed ventrally. The shell is only slightly longer than high, and its outline shaped somewhat like a trapezium, the dorsal margin being shorter than the ventral and the anterior and posterior margins sloping obliquely downwards. In the two specimens preserved in spirit in the Museum collection, the mantle is seen well reflected over the shell and is covered all over with numerous small, tentacular processes. Though the ventral margin is closed, the anterior and posterior margins are observed to be slightly gaping towards the dorsal side. The shells in the collection are all faded and whitish, having lost their original orange tinge. Shingle Island.

SERIES CHAMACEA.

Family CHAMIDAE.

The shell is large, thick and inequivalve, the left valve being usually deeper and attached to some substratum. The umbones are large and well developed. The hinge margin is very thick and is provided with a single large, protruding tooth, which is finely denticulated at its

edge. The surface of the shell is beset with rows of large processes which may be flattened and lamelliform or curved deeply.

This family includes a single genus, *Chama*.

Genus **Chama** (Linné, 1758) Bruguière, 1789.

With the characters of the family.

Two sub-genera, *Chama s. str.* and *Pseudochama* are represented in the Krusadai collection. The latter is readily distinguished from the former by the right valve being attached, instead of the left, and by the left valve being more strongly sculptured with concentric laminae than the right.

Sub-genus **Chama s. str.**

Three species of *Chama s. str.* have been recorded from the Pamban area, but in view of the enormous range of variation prevalent in this family, it is not possible to give a strictly diagnostic key for the separation of these species. It is hoped, however, that the following key will be of some help in distinguishing them, especially when the specimens are fresh and unworn :—

1. Concentric lamellae on the surface of the shell large and conspicuous, bearing numerous large processes, flattened, or often more or less incurved with their concavities turned away from the umbo, somewhat irregularly disposed and differing much in size 2

— Concentric lamellae finer, and more close-set bearing numerous small, deeply vaulted scales more regularly arranged and more uniform in size and shape. Outer surface of shell marked all over with reddish spots .. .. *C. fragum.*

2. Shell usually deep pinkish, this colour being specially well marked on the interior towards the margin. Margin of the inner surface slightly reflected (i.e., tilted up) and traversed by an unbroken line of very closely set, minute, tubercle-like teeth, about 2 or 3 mm. from the edge of the valves .. .. *C. reflexa.*

— Shell generally whitish. Interior of shell sometimes tinged with a pale fleshy pink, especially towards the margin. Margin of the inner surface not reflected, smooth and not crenulated. Shell usually smaller and the attached valve relatively much deeper .. .. *C. lazarus*.

Chama reflexa, Reeve.

Plate XIII, figs. 1*a* and 1*b*.

Chama reflexa, Reeve, Conch. Icon., IV, 1846, pl. iv, fig. 16.
Chama reflexa, Tryon, Proc. Acad, Nat. Sci. Philadelphia, XXIV, 1872, p. 119.
Chama reflexa, Clessin, Conch. Cab., 1889, p. 24, pl. viii, figs. 1 and 2.
Chama reflexa, Mar. Fauna Queensland, Austral. Assoc. Adv. Sc., 1909, p. 347.
Chama reflexa, Odhner, Res. Mjobergs Swed. Sc. Exp. Australia. Moll., 1917, p. 29.
Chama reflexa, Lamy, Chames Mer Rouge, Bull. Mus. d'Hist. Nat. Paris, XXVII, 1921, p. 239.
Chama reflexa, Lamy, Journ. de Conchyl., LXXI, 1927, p. 326.
Chama reflexa, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 46.

This species, which is also recorded from the Madras area, is much commoner than the next two, and presents a good deal of variation. Specimens of this species have been collected, both as living animals attached to rocks like the oysters, and as dead shells washed up on the beach. The shells sometimes occur in clusters, but this condition is observed in the case of the other species also. The shell is thick and massive, attached by the left valve firmly to some solid substratum such as rocks and wooden piers. The attached left valve is deeper than the free right valve which closes the shell cavity as a lid. The hinge is thick and bears a massive, transversely elongated tooth on the left valve which fits into a corresponding depression in the opposite valve. The space immediately above the tooth is deeply excavated. Both valves are concentrically lamellated and bear large, scaly processes which are developed to a varying degree in different specimens. They may be flattened or more or less curved, their concavities facing towards the lower margin of the shell. The shell is pinkish, the colour being particularly well marked towards the margin of the inner surface. But the shells collected are often bleached to a varying degree, and worn shells are almost completely white. The margin of the shell is slightly reflected and bears a continuous row of minute, close-set teeth on the inside just within the border. The shells vary considerably in form and colour, their shape being determined, to a great extent, by the nature of the surface of attachment and the amount of available space in the situation where the shell is growing. Pamban and Shingle Island.

Chama lazarus Linné.

Plate XIII, figs. 2*a* and 2*b*.

Chama lazarus, Linné, Syst. Nat., Ed. X, 1758, p. 1139 (non Lamarck).
Chama lazarus, Bruguière, Encyclopédie Méthodique, Vers. I, 1792, p. 387.
Chama lazarus, Catlow & Reeve, Conch. Nomencl., 1845, p. 70.
Chama lazarus, Reeve, Conch. Icon., IV, 1847, *Chama*, pl. ii, fig. 4.
Chama damaecornis, Chenu, Man. de Conchyl., II, 1862, p. 116, figs. 550 and 551.
Chama lazarus, Odhner, Res. Mjobergs Swed. Sc. Exp., Australia, Moll., 1917, p. 28.
Chama damaecornis, Lamy, Bull. Mus. d'Hist. Nat. Paris, XXIII, 1917, p. 202.
Chama lazarus, Lamy, Journ. de Conchyl., LXXI, 1927, p. 305.
Chama lazarus, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 295.
Chama lazarus, Thiele, Handbuch der systematischen Weichtierkunde, pt. ii, 1935, p. 877, fig. 831.

The specimens of this species represented in the Museum collection are much smaller than those of *C. reflexa*, and appear to be young shells. The shell is rounded and the attached left valve is relatively deeper than in the preceding species. The concentric lamellae are large, overlapping and foliaceously extended into large, distally enlarged processes which are curved to a varying degree. Towards the umbones, the processes become small and inconspicuous. When closely examined with a lens, some of the processes are observed to be traversed by fine transverse striae. The hinge is moderately thick and the single hinge tooth on the left valve is relatively smaller and has a finer edge than in *C. reflexa*. The umbonal recess in the left valve beneath the hinge shelf is relatively deeper and more spacious in this species than in the preceding one. The shell is white, but a few valves in the collection show a pale pinkish tinge on the inner surface towards the margin. The margin of the inner surface is smooth and not crenulated as in *C. reflexa*. Two or more specimens may occur in a cluster and may be collectively attached to the substratum by their left valves. Pamban.

Chama fragum Reeve.

Plate XIII, figs. 3*a* and 3*b*.

Chama fragum, Reeve, Proc. Zool. Soc., London, 1846, p. 117.
Chama fragum, Reeve, Conch. Icon., IV, 1847, *Chama*, pl. ix, fig. 48.
Chama fragum, Angas, Proc. Zool. Soc. London, 1865, p. 65.
Chama fragum, Clessin, in Martini-Chemnitz, Conch. Cab., VIII, 4 Abth., 1889, p. 22, pl. x, figs. 2 and 3.
Chama fragum, Crosse & Fischer, Journ. de Conchyl., XL, 1892, p. 76.
Chama fragum, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Chama fragum, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 840.
Chama fragum, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 168.
Chama fragum, Lamy, Journ. de Conchyl., LXXI, 1927, p. 367.

This species is rarer than either of the two preceding species, and is represented in Mr. Crichton's collection by a single shell in which both valves are intact. The valves are very thick and solid, and the left valve bears, in the present specimen, an enormous swelling beneath the hinge, which reduces the cavity of the shell to a considerable extent, but this peculiar feature appears to be an individual variation rather than a specific character. The shell has a somewhat irregularly rounded outline. The left valve, as usual, is deeper than the

right, but the latter is relatively much deeper than the corresponding valve in the two preceding species, and consequently the total thickness of the shell from side to side is proportionately greater in this species and very nearly equals the vertical height of the valves (i.e., the distance from the umbo to the middle of the lower margin). Both the valves are concentrically lamellated on the outside. The lamellae are numerous, close-set and overlapping and carry a large number of small, downwardly directed, scale-like processes, closely and regularly arranged. They are almost uniform in size, except for the slight increase in size towards the ventral margin. The presence of these close-set processes gives the lamellae an undulated appearance in an end view. The hinge tooth and the corresponding depression in the opposite valve are disposed as in *C. reflexa*. The inner surface is smooth, but its margin is finely grooved, though no definite teeth are developed. The interior of the shell is whitish. The outer surface is also white, but marked all over with small reddish spots. Pamban.

Sub-genus **Pseudochama** N. Odhner, 1917.

Pseudochama cristella (Lamarck).

Plate XIII, figs. 4*a* and 4*b*.

Chama cristella, Lamarck (non Clessin), Anim, sans vert., VI, 1819, p. 96.
Chama cristella, Deshayes, Anim. sans. vert., Ed. II, Vol. VI, 1835, p. 585.
Chama cristella, Hanley, Cat. Recent Bivalve Shells, 1843, p. 227.
Chama cristella, Reeve, Conch. Icon., IV, 1847, pl. viii, fig. 42.
Chama cristella, Angas, Proc. Zool. Soc. London, 1865, p. 651.
Chama cristella, Tryon, Proc. Acad. Nat. Sci. Philadelphia, XXIV, 1872, p. 117.
Chama Reeveana, Clessin, Conch. Cab., 1889, p. 36, pl. xvi, figs. 3 and 4.
Chama cristella, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 168.
Pseudochama cristella, Odhner, Res. Mjobergs Swed, Sc. Exp. Australia, Moll., 1917, p. 30.
Chama cristella, Lamy, Bull, Mus. d'Hist. Nat. Paris, XXIII, 1917, p. 266.
Chama cristella, Lamy, Journ. de Conchyl., LXXI, 1927, p. 347.

A single left valve belonging to this sub-genus, and represented in Mr. Crichton's collection has been provisionally identified as *Pseudochama cristella*, as the specimen approximates very closely to Reeve's figure and description of *Chama cristella* (*loc. cit*). But a more detailed examination of entire specimens and comparison with other authentically identified specimens are necessary to confirm this identification. The shell is thick, and considerably deep. The anterior inclination of the umbo is much more pronounced in this species than in those of *Chama s. str.*, and this feature gives the umbonal region of the shell a deeply curled appearance, which Reeve aptly describes as " circuitously triangular. " The shell is more or less circular in outline and the left valve, which is the free valve in this sub-genus, is of considerable depth. The hinge area is moderately extensive and the hinge tooth and the depression above it are the same as in *Chama s. str.*, but the crenulations on the surface of the tooth are deeper and more prominent. The concentric lamellae on the outer surface of the shell are very well developed, but instead of bearing numerous, well separated scaly processes as in *Chama s. str.*, they are themselves deeply and flexuously wrinkled, and what appear to be

processes are really the crested portions of the otherwise continuous, wave-like laminae These laminae are closely pressed to the surface of the shell posteriorly, but gradually become elevated as they approach the anterior side, and near the front margin they stand erect almost at an angle of 90 ° to the surface of the shell. The shell is white, both inside and outside. The interior of the shell is smooth, its marginal portion being slightly reflected and extending as a flattened rim all round the valve, and separated from the rest of the surface by a fine, thread-like groove. Pamban.

SERIES CARDIACEA.

Family CARDIIDAE.

This family includes the shells popularly known as cockles. The shell is equivalve, sometimes almost equilateral, but sometimes markedly inequilateral. The shell is almost always strongly radially ribbed, often about as high as long, but sometimes higher than long. The hinge bears two cardinal teeth and two lateral teeth. Of the two cardinal teeth, the anterior one is inclined to be much more well developed than the posterior. The laterals are situated a little distance away from the umbo. The pallial line is entire and the hinge ligament external.

This is a large and important family of bivalves, including numerous well known and widely distributed species. The species that have so far been recorded from the Pamban area belong to two genera, *Cardium* and *Lunulicardia*. The former, however, has been subsequently split up into a number of sub-genera such as *Trachycardium*, *Ringicardium*, etc., but in the present monograph, I have not entered into the details of these subgeneric distinctions. Six species of *Cardium* and one of *Lunulicardia* have been recorded from Pamban and Krusadai Island area. They may be distinguished as follows :—

1. Surface of shell evenly curved. Ventral margin of shell uniformly rounded. Lunule only slightly depressed or not depressed at all . . . . 2 (*Cardium*).

— Surface of shell with a strongly developed keel running down from the umbo to the ventral margin, slightly anterior to the middle line. Lower margin of shell markedly angular at the point where the keel terminates. Lunule deeply sunk . . . . *Lunulicardia retusa*.

2. Ribs very feebly developed and almost obsolete in the middle part of the surface of the shell. Shell rather thin and inclined to be smooth and glossy in the middle part, especially towards the umbo. Shell generally mottled with brownish markings, and purplish towards the umbo . . 3

— Radial ribs strongly developed throughout. Shell usually thicker and coarser, the surface being never smooth and glossy. Shell not coloured as above, generally uniformly whitish or pale fleshy pink .. 4

3. Shell about as high as long. Ribs very numerous and very closely set. Posterior side of shell normal, not produced .. .. *C. australe.*

— Shell somewhat thinner and more fragile, definitely longer than high. Ribs comparatively less numerous and more widely separated. Posterior side of shell somewhat produced .. .. .. *C. papyraceum.*

4. Shell markedly oblique, very inequilateral, much longer than high. Ribs flattened, and set very close together, separated by very fine, thread-like radial grooves. Shell often found with remains of a brownish, scaly periostracum .. .. .. *C. setosum.*

— Shell not markedly oblique, the longest dorso-ventral axis being nearly perpendicular to the ventral margin, almost equilateral. Ribs well raised and rounded, the interstices between them being broader and deeper. Shell not longer than high. Remnants of periostracum rarely persistent 5

5. Shell thick, solid, decidedly higher than long. Interior of shell smooth, surface of ribs somewhat rough and inclined to be finely transversely crenulated. Grooves separating the ribs narrower than the ribs. Hinge teeth thick 6

— Shell thinner, just about as high as long. Inner surface of the valves strongly radially ribbed, these internal ribs corresponding in position to the radial grooves on the outer surface. External ribs strongly crested, especially the posterior ones and towards the ventral margin. Grooves between the external ribs as broad as the ribs themselves. Hinge teeth thin .. .. *C. asiaticum.*

6. Shell relatively much higher in proportion to its length. Shell pale pinkish, marked with irregular blotches of a darker pink. Ribs finely serrated. Six or seven of the extreme hind ribs conspicuously tuberculated .. .. *C. assimile.*

— Shell not so high in proportion to its length, whitish, sometimes with a pale yellowish tinge. Ribs broader and stouter, the posterior ones being transversely ridged and some of the anterior-most bearing short, spine-like processes. Shell broader and slightly more oblique .. .. *C. flavum.*

Genus **Cardium** Linné, **1758.**

The shell is rounded or somewhat elongated, with radial ribs which are often tuberculated, scaly or spiny. The umbo is conspicuously projecting and situated near the middle. The hinge margin is slightly curved and bears the cardinal and lateral teeth.

Cardium flavum Linné.

Plate XIV, figs. 1*a* to *c*.

Cardium flavum, Linné, Syst. Nat., Ed. X, 1758, p. 680.
Cardium rugosum, Lamarck (non Reeve), Anim. sans vert., VI, 1819, p. 10.
Cardium rugosum, Sowerby, Conch. Illustr,, 1838, p. 5,figs. 37 and 41.
Cardium Pectiniforme, Hanley, in Wood, Index Test., 1856, p. 35, pl. v, fig. 37.
Cardium dupuchense, Reeve, Conch. Icon., II, 1845, *Cardium*, pl. xiv, fig. 67.
Cardium rugosum, Mitchell, Cat. Mus. Madras, 1867, p. 67.
Cardium rugosum, Angas, Proc. Zool. Soc. London, 1877, p. 192.
Cardium rugosum, Melvill & Sykes, Proc. Malacol. Soc. London, III, 1898, p. 48.
Cardium (*Trachycardium*) *flavum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 160.
Cardium flavum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 266.

This is by far the commonest species of *Cardium* recorded from Krusadai and numerous dead shells have been collected from the beaches at Pamban, Krusadai and Shingle Islands, besides a few living specimens from the mud flats at Kundugal Point. The specimens identified as *C. rugosum* in the previous published list of Krusadai Lamellibranchs [*Bull. Mad. Govt. Mus.* (*Nat. Hist.*), I, 1927, p. 97] should be correctly referred to the present species as *C. rugosum* Lamarck is a synonym for *C. flavum*. Prashad considers *C. dupuchense* Reeve as synonymous with the present species and *C. rugosum* of Reeve as a different species altogether.

The shell is moderately large, thick, whitish, somewhat higher than long and very strongly radially ribbed, the ribs numbering about 28 to 30, and the interstitial grooves being

fairly deep. The surfaces of the posterior ribs are beset with numerous white, transverse ridges which almost approximate the form of tubercles in the extreme hind ribs, especially towards the umbo. The median ribs are smooth except for the concentric growth lines which occur throughout the shell, some of these being more strongly developed than the rest. A few of the extreme anterior ribs bear spine-like processes. The interstices between the ribs are narrower than the ribs, but rather deep and finely transversely grooved with growth lines. The shell is slightly oblique (i.e., the longest dorso-ventral axis from the umbo is not exactly vertical, but slightly shifted anteriorly) The front margin is somewhat straight and truncated, while the hind margin is more evenly rounded. The hinge teeth are stout. The interior of the shell is smooth, but the margin appears strongly dentated owing to the presence of the terminations of the external radial ribs. In some shells, however, the interior shows faint radial grooves corresponding to the ribs above. Young shells are comparatively more broadly and regularly rounded, and are about as high as long. The shell is white, often with a pale yellowish tinge, when fresh. Most of the specimens collected are empty valves washed up on the beach. Kundugal Point, Pullivasal, Krusadai and Shingle Islands.

Cardium asiaticum Bruguière.

Plate XIV, figs. 2*a* and 2*b*.

Cardium asiaticum, Bruguière, Encyclopédie Méthodique, Vers. I, 1792, p. 224, No. 19, pl. 293, fig. 2.
Cardium asiaticum, Reeve, Conch. Icon., II, 1844, *Cardium*, pl. iv, fig. 20.
Cardium asiaticum, Martini-Chemnitz, Conchyl. Cabin., X, 2 Abth., 1869, p. 66, pl. ii, figs. 4 and 5.
Cardium asiaticum, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 159.
Cardium lima, Spengler, Schroter, Einleit, in d. Conchylienkenntn., III, 1786, p. 53.
Cardium lamellatum, Spengler, Skrivter af Naturhistorie Selskabet, V, 1799, p. 8.
Cardium (*Bucardium*) *Asiaticum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 159.
Cardium asiaticum, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 192.
Cardium asiaticum, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 47.

This species is almost as well represented at Krusadai as the preceding one. Empty shells have been found in fairly large numbers on the beaches, particularly on the mud flats at Kundugal Point, along the shore line facing Krusadai Island. This species may be readily distinguished from the preceding one by the shell being much thinner, deeper, almost perfectly equilateral, symmetrically rounded, just about as high as long, and by the ribs being relatively narrower and more numerous. The surface of the ribs appear to be smooth, except for the posterior ribs which are strongly crested towards the margin, but on closer examination, the middle and the anterior ribs are observed to be entirely smooth only near the umbo, the rest of their surface being beset with minute, dot-like tubercles of which only a single central row is conspicuous. The ribs numbering about thirty-seven to thirty-nine are well raised, narrow and sharply separated by well defined, deep grooves,

the floor of these grooves being flat and profusely dotted all over with very minute tubercles. The shell bears a symmetrically rounded outline, and is just about as high as long. The shell valves are rather thin compared to the preceding species, and rather strongly inflated, their depth being relatively greater than in the other species recorded from Pamban. The hinge teeth are thin and sharp. The inner surface of the shell is strongly ribbed radially, these ribs corresponding in position with the radial grooves on the outer surface—a feature which may be attributed to the relative thinness of the shell valves. The shell is whitish, tinged with pale yellow in the middle and suffused with a fine purplish rose colour towards the posterior margin. Some shells are greyish black, but this is apparently secondary, and is almost always due to the impregnation by the dark silt found in the areas from which such valves are usually picked up. Krusadai Island and Kundugal Point.

Cardium setosum Redfern.

Plate XIV, figs. 3*a* and 3*b*.

Cardium latum, Chemnitz, Conch. Cab., VI, 1782, p. 197, pl. 19, figs. 192 and 193.
Cardium setosum, Redfern, Ann. Lyceum, Nat. Hist. New York, IV, (1846) 1848, p. 168, pl. xi, fig. 1.
Cardium latum, Reeve (non Born), Conch. Icon., II, 1844, *Cardium*, pl. iv, fig. 21.
Cardium latum, Catlow & Reeve, Conch. Nomencl., 1845, p. 43.
Cardium setosum, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 158.
Cardium setosum, Hidalgo, Obres malacologicas I, tom. II, 1903, p. 329, No. 428.
Cardium (*Acanthocardium*) *setosum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 158.
Cardium setosum, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 47.

This species is readily distinguished from the remaining species of Krusadai Cardiidae by the shell being strongly oblique, very inequilateral and much longer than high. The shell at first sight appears more like that of one of the elongated species of *Arca*. The shell is white, transversely oblong, with the longest dorso-ventral axis running obliquely from the umbo towards the hind part of the ventral margin. The ribs number about forty. They are markedly flattened, very closely set, and each of them bears a fine, median longitudinal groove from which arises a row of spines which are found intact only in fresh specimens; they are generally reduced to small granules in partially worn shells, and are observed to persist longest towards the margins, but in very old and greatly worn out shells they completely disappear. The ribs are separated by fine, thread-like grooves, which are occupied by minute brownish scales of the periostracum in fresh shells. The hinge teeth are well developed, the anterior lateral tooth being specially large and prominent. The posterior lateral tooth is removed a considerable distance away from the umbo. The interior of the shell is pure white, smooth and highly polished, but the margin of the inner surface is conspicuously cut up into a series of squarish, truncated teeth corresponding to the terminations of the external radial grooves. Externally the shell is white, sometimes tinged with pale yellow. Krusadai and Shingle Islands.

Cardium assimile Reeve.

Plate XIV, figs. 4*a* and 4*b*.

Cardium assimile, Reeve, Proc. Zool. Soc. London, 1844, p. 169.
Cardium assimile, Reeve, Conch. Icon., II, 1844, *Cardium*, pl. ix, fig. 45.
Cardium assimile, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 46.

This species is easily distinguished from the remaining Pamban species of *Cardium* by the shell being markedly higher than long. The shell is slightly oblique, and more or less oval in shape. There are about thirty-two well raised, moderately narrow, close-set radiating ribs with deep interstices between them. The anterior ribs are finely transversely toothed. The median ribs are smooth at the top, but finely toothed at the sides. Five or six of the extreme posterior ribs are conspicuously tuberculated. The strongly raised ribs and the well excavated interstices between them give the margin of the shell a deeply undulating appearance in an end view. In worn shells the serrations at the sides of the median ribs are scarcely seen. The interior of the shell is smooth and white, tinged, here and there with pale pink, but the positions of the external radial ribs are indicated on the inner surface by opaque white radiating lines. The margin of the inner surface is deeply dentated. The hinge teeth are stout and well developed. The shell is pale yellowish brown, mottled with large irregular purplish red blotches, but the part near the umbo is almost white. Kundugal Point, Krusadai and Shingle Islands.

Cardium australe Sowerby.

Plate XIV, fig. 5.

Cardium australe, Sowerby, Conch. Illustr., 1834, p. 1, fig. 12.
Cardium australe, Sowerby, Proc. Zool. Soc. London, 1841, p. 105.
Cardium australe and *Cardium pulchrum*, Reeve, Conch. Icon., II, 1844, *Cardium*, pl. xix, figs. 97 and 98.
Cardium australe, Catlow & Reeve, Conch. Nomencl., 1845, p. 42.
Cardium (*Bucardium*) *australe*, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 160.
Cardium australe, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 837.
Cardium (*Laevicardium*) *australe*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 163.
Cardium australe, Pelseneer, Siboga-Expeditie, Lamellibranches (Anat.), 1911, pp. 56 and 57.
Cardium (*Laevicardium*) *australe*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 280.
Cardium australe, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 46.

This species is represented by a few dead shells collected on the Krusadai beach, both in the Museum's original collection and in Mr. Crichton's collection. The shell is rather thin and is distinguished from those of the preceding species by its much weaker sculpture and by its surface being more or less glossy in the middle and towards the umbones. The shell is rather obliquely ovate and is about as high as long. The surface of the shell is very finely radiately ribbed. The ribs are numerous, close-set and are more or less obsolete towards the middle of the surface of the shell and towards the umbones, these parts of the surface being almost smooth and glossy. The ribs are slightly more pronounced towards

the posterior side of the shell. The shell is purplish when young. Older shells are whitish, characteristically clouded or mottled with pale purplish pink or brown markings, and purplish towards the umbo. The extreme anterior and posterior areas of the shell are banded with reddish purple, while the interior of the shell is pale brownish with a single purplish ray extending from beneath the umbo. The umbonal areas of the surface are highly polished. Pamban and Krusadai Island.

Cardium papyraceum Chemnitz.

Plate XIV, figs. 6*a* and 6*b*.

Cardium papyraceum, Chemnitz, Conchyl. Cabin., VI, 1782, p. 190, pl. xviii, fig. 184.
Cardium papyraceum, Reeve, Conch. Icon., II, 1844, *Cardium*, pl. ii, fig. 9.
Cardium muticum, Reeve, ibid., pl. vi, fig. 32.
Cardium papyraceum, Dunker, Index Moll. Mar. Japonicum, 1882, p. 211.
Cardium papyraceum, Martini-Chemnitz, Conchyl. Cabin., X, 2 Abth., 1869, p. 78, pl. iii, fig. 4; pl. xii, figs. 19 and 20.
Papyridea papyracea, Hidalgo, Obres. malacologicas, I, tom. II, 1903, p. 344, No. 444.
Cardium (*Papyridea*) *papyraceum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 162.

Two empty valves of the shell of this species are represented in the Museum collection. The shell is thin and fragile and the radial ribs on the surface are very feebly developed as broad, flattened, very feebly raised ridges separated by fine striae. The ribs become somewhat inconspicuous towards the central and umbonal areas of the surface, where the shell is slightly glossy. The shell is distinctly longer than high and inequilateral, its posterior side being rather produced and the umbo being placed a little anterior to the middle line. The shell can hardly be said to be ribbed, in the strict sense of the term, for the 'ribs in this species are nothing more than the broad, flattened interspaces between the fine, thread-like striae which represent the interstitial grooves in this species. These striae appear finely pitted, especially towards the ventral margin. The hinge teeth are thin and finely pointed. The part of the shell surrounding the umbo is thin and rather translucent. The inner surface of the shell is smooth except at the hind margin where it is finely crenulated. The weak sculpture and the smooth and glossy umbonal areas are characteristic of this species. The shell is whitish or pale yellowish brown with irregular, hazy, purplish pink blotches. The umbones are purplish brown. The interior of the shell is white, heavily clouded with pink, particularly towards the posterior margin. Pamban.

Genus **Lunulicardia** Gray, 1853.

The shell bears a strong, oblique keel running down from the umbo. The lunule is deeply sunk.

Thiele treats this as a sub-genus under *Cardium*, but I have followed Dr. Gravely in treating it as a distinct genus allied to *Cardium*, in view of the marked differences in the shell.

A single species, which has also been recorded from Madras, is represented at Krusadai.

Lunulicardia retusa (Linnè).

Plate XIV, figs. 7*a* and 7*b*.

Cardium retusum, Linné, Syst. Nat., Ed. XII, 1767, p. 1121.
Cardium retusum, Bruguière, Encyclopédie Méthodique, Vers. I, 1789, p. 210.
Cardium retusum, Lamarck, Anim. sans vert., VI, 1819, p. 15.
Cardium subretusum, Sowerby, Proc. Zool. Soc. London, 1840, p. 110.
Cardium subretusum and *C. retusum*, Reeve, Conch. Icon., II, 1845, *Cardium*, pl. xix, figs. 100 and 103.
Lunulicardia retusa, Gray, Ann. & Mag. Nat. Hist., (2) XI, 1853, p. 41.
Cardium (*Lunulicardia*) *subretusum*, Melvill & Standen, Journ. de Conchyl., IX, 1898, p. 82.
Hemicardium (*Lunulicardia*) *retusum*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 164.
Lunulicardia retusa, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, pp. 287–289.
Lunulicardia retusa, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 46.

Several empty valves of this species have been collected from the Krusadai beach. The shell is readily distinguished from those of the preceding species of this family by the presence of a strongly developed keel running down the middle of the shell from the umbo to the lower margin, which is distinctly angular at the point of termination of the keel, and not evenly rounded as in species of *Cardium*. The shell is considerably deep, the valves being strongly inflated, higher than long, and somewhat heart-shaped in outline. The umbo is strongly curved inwards and the lunule is deeply excavated, a slight swelling of its umbonal border protruding into it. The hinge teeth are strong and there are deep pits developed beneath the lateral teeth. The shell is strongly radially ribbed. The ribs are broad and well rounded, and number about twenty-two. The vertical keel divides the shell into two parts, an anterior and a posterior. The anterior part is much broader and its surface slopes rather gradually down from the keel to the front end and the ribs in this part are broader and somewhat more widely spaced than those on the posterior part. The part of the shell behind the keel is narrower, its surface slopes down much more steeply from the keel to the hind margin and the ribs in this part are comparatively narrow and more closely set. The interstices between the ribs are transversely grooved. The interior of the shell is smooth, except towards the ventral margin where it is faintly radially grooved in correspondence with the external sculpture. The shell is white, both inside and outside. This is a well known and widely distributed species and has been popularly called by French conchologists as "Diana's Heart Cockle." Krusadai Island.

Family TRIDACNIDAE.

This family includes the largest of bivalves, commonly known as Giant Clams. The shell attains an enormous size and its weight is sometimes said to amount to several hundreds of pounds. The shell is thick, massive, equivalve, gaping in front and broadly radially ribbed, or rather, thrown into broad radial folds. The pallial line is entire and devoid of a sinus. The foot is short and bears a byssus with which the animal remains attached throughout life.

The single Pamban species of this family belongs to the genus *Tridacna*.

Genus **Tridacna** Bruguière, 1789.

The shell is very large and thick, elongately triangular, with radial ribs and folds, which are traversed by scaly ridges. The hinge margin always bears one cardinal tooth and one lateral tooth on the left valve and two posterior lateral teeth on the right valve.

A single left valve of *T. elongata* is the sole representative of this genus among the Pamban specimens of bivalves in the Museum collection. The two huge valves of the Giant Clam exhibited in the Invertebrate gallery of the Museum were obtained from the Laccadive Islands, and belong to the species *T. cumingii*.

Tridacna elongata Lamarck.

Plate XV, figs, 1*a* and 1*b*.

Tridacna elongata, var. a, Lamarck, Anim. sans vert., VI, 1819, p. 106.
Tridacna elongata, Deshayes, Encyclopédie Méthodique, Vers. III, 1831, p. 1045.
Tridacna lanceolata, Sowerby, Thes. Conchyl., V, 1884, p. 181.
Tridacna elongata, Brazier, Mem. Austral. Mus., II, 1889, p. 28.
Tridacna Reevei, Hidalgo, Mem. Real Acad. Cienc. Madrid, XXI, 1903, p. 389.
Tridacna elongata, Iredale, Proc. Zool. Soc. London, 1914, p. 666.
Tridacna elongata, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 293.
Tridacna elongata, Hedley, Mem. Austral. Mus., XIII, 1921, p. 167, pl. xxx, fig. 8.
Tridacna elongata, Thiele, Faun. Sudwest Austral., V, 1930, p. 592.

According to Prashad, the species figured by Reeve as *T. elongata* is actually *T. maxima* Röding. The single left valve of *T. elongata* represented in the collection of shells presented to the Museum by Mr. Crichton measures about 3¼ inches in length and is apparently a very young specimen. The shell is considerably elongated transversely and is fully about twice as long as high. The shell bears six, broadly rounded, convexly raised ribs, with wide and deep interstices between them. Each of these interstices is traversed by two close-set, radial ridges. The margin of the shell is thrown into characteristic, broad indentations which correspond with the terminations of the broad external radial ribs. The surface of the radial ribs is traversed by broad, curved, transverse, scaly processes considerably raised above the general surface level of the shell, their concavities facing

away from the umbo. The shell is strongly inequilateral, the umbo being placed well behind the middle line. The hinge bears two large posterior teeth, the hinder one of which is transversely elongated. In front of the umbo the hinge bears about five or six serrations The shell is white, both within and without. The single valve in the collection bears numerous worm tubes and small patches of encrusting corals on its inner surface. In old shells there is a distinct ventral gape between the two valves. This species is widely distributed in the Indo-Pacific Region. Pamban.

SERIES VENERACEA.

Family VENERIDAE.

This large and heterogenous family of bivalves comprises numerous genera of which a fairly good number are represented at Krusadai. Shells popularly known as clams are included in this family. The shell is usually equivalve, thick, either smooth or variously sculptured, often with a lunule, which is more or less distinctly flattened or depressed. The hinge usually bears three cardinal teeth and a simple anterior lateral tooth on the left valve and a corresponding depression on the right valve. The pallial impression is almost always sinuate. There are two adductor impressions, slightly unequal in size. The foot is well developed and laterally compressed.

The Pamban species of this family belong to so many different genera that I have drawn up the following tabular analysis of the salient features of these genera, which together with the usual dichotomous key which follows later, will prove helpful in distinguishing the genera of this large and confusing group. The key drawn up by Dr. Gravely for the Madras genera of Veneridae (*Bulletin of the Madras Government Museum, New Series, Natural History Section*, V, No. 1, 1941, page 47) will also be found useful while dealing with this family.

TABULAR STATEMENT OF THE PRINCIPAL SHELL CHARACTERS OF THE GENERA OF THE FAMILY VENERIDAE REPRESENTED AT KRUSADAI

TABULAR ANALYSIS OF THE VARIOUS

Number.	Genus.	A. *Convexity of the valves.*	B. *Sculpture.*	C. *Pallial line.*
(1)	(2)	(3)	(4)	(5)
1	*Circe*	Flattened	Close, concentric	Slightly sinuate
2	*Gafrarium*	Inflated	Concentric or radial or both. Usually tuberculated.	Do.
3	*Meretrix*	Do.	Smooth and glossy. Horny periostracum usually conspicuous.	Entire, not sinuate
4	*Pitar*	Moderately inflated	Sometimes indistinct, but more often with strong concentric grooves separated by flattened ridges.	Deeply sinuate
5	*Sunetta*	Flattened, or very feebly inflated.	Smooth, or finely concentrically grooved.	Do.
6	*Dosinia*	Moderately inflated	Fine, very closely set concentric grooves.	Deep, inverted 'V'-shaped sinus present.
7	*Venus*	Inflated	Strong, concentric crested ridges, with or without radial ridges in the interstices. Sometimes strongly tuberculated.	With a broad 'U'-shaped sinus.
8	*Antigona*	Do.	Crested concentric ridges, with radial double ridges in between.	Deeply sinuate
9	*Chione*	Slightly inflated	Widely-spaced concentric laminae, or close reticulate sculpture throughout.	Deeply or moderately sinuate.
10	*Periglypta*	Inflated	Reticulated	Deeply sinuate
11	*Venerupis*	Moderately inflated	Crested, widely spaced concentric laminae with fine radial grooves in between.	Do.
12	*Catelysia*	Inflated	Smooth and glossy. Faint concentric growth striae present.	Do.
13	*Paphia*	Moderately inflated	Smooth, or with weak concentric grooves.	Do.
14	*Tapes*	Do.	Do.	Do.
15	*Irus*	Rather flattened	Strong, widely spaced concentric crests.	Pallial sinus usually short and angular.

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[1] The word "normal" in column 7 implies that there is in the left valve a tooth in front of the

KRUSADAI GENERA OF VENERIDAE.

D. *Lunule.* (6)	E. *Hinge teeth.* (7)	F. *Thickness.* (8)	G. *Proportions of height and length.* (9)
Slightly depressed, much elongate, being more than three times as long as wide.	Normal[1]	Rather thin or moderate.	Slightly longer than high. Hind end truncated.
Flattened and distinct	Normal, thick	Thick	Longer than high.
Not flattened. Inconspicuous.	Normal, but the anterior lateral tooth in the left valve and the depression on the right are characteristically striated.	Very thick and solid	Slightly longer than high.
Flat, short, broad and heart-shaped.	Normal	Sometimes rather thin for its size, but more often moderately thick.	Longer than high. End rounded. Umbo rather strongly inclined forwards.
Long, narrow, deeply depressed.	Tooth in front of cardinal elongate.	Moderately thick	Markedly longer than high Margin of inner surface dentated.
Short, broad, deeply depressed and heart-shaped.	Tooth in front of cardinal absent.	Thin to moderate	Regularly rounded, as high as wide. Umbo strongly bent forwards and beak-like.
Short, broad and concavely depressed.	Tooth and hollow in front of cardinal rudimentary or absent.	Variable, often thick and solid when large.	Proportions variable. Usually longer than high. Hind margin often truncated. Margin of inner surface finely crenulated.
Concavely depressed, short, broad, and heart-shaped.	Rather thin, sharp and pointed.	Thick	Longer than high. Hind margin truncated.
Not well defined and flattened; almost obsolete.	Thin. Tooth and hollow in front of umbo reduced.	Rather thin	About as high as long. Hind margin rounded or truncately indented.
Flattened, distinct	Stout, normal	Thick	Longer than high. Hind margin broad and truncated.
Not flattened and distinct. Almost obsolete.	Comparatively small. Tooth and hollow in front of cardinal reduced.	Moderately thick	Longer than high. Oblong. Hind end truncated. Outline somewhat angular.
Flattened, elongately ovate.	Sharp. Tooth and hollow in front of cardinal absent.	Thick	Only slightly longer than high. Hind margin rounded.
Flattened, narrow and greatly elongate.	Three-toothed, diverging at approximately equal angles.	Moderately thick	Much longer than high. Hind margin narrow and rounded.
Do.	Do.	Do.	Much longer than high. Hind margin broad and truncated.
Not well defined	Hinge margin small and very short. Teeth often irregular, usually two, and always striated.	Slightly thick	Much longer than high, the umbo being very near the front end. Posteriorly narrowed and truncated.

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cardinal and on the right a corresponding hollow which is the usual condition in the Veneridae.

KEY TO THE KRUSADAI GENERA OF VENERIDAE.

(Based on the above analysis of characteristic features).

1. Shell strongly flattened, with concentric sculpture only, consisting of very closely set concentric grooves .. .. *Circe.*

— Shell not so markedly flattened as in the above. Shell inflated to a varying degree, either smooth or more often with radial or concentric sculpture or both 2

2. Pallial line not sinuate, entire, or pallial sinus, when present, very short and shallow 3

— Pallial line deeply sinuate, the pallial sinus being generally broadly rounded, or more rarely pointed and angular 5

3. Shell rather compressed, not very thick, oblong, much longer than high. Outline of shell rather angular, being somewhat narrowed and truncated posteriorly. Shell ornamented with widely spaced, raised, concentric laminae .. .. *Irus.*

— Shell more or less inflated, very thick and solid, about as high as long, and with an evenly rounded outline. Sculpture not as above, either smooth and glossy or ornamented with close-set concentric grooves and radial ribs which are often tuberculated 4

4. Shell smooth and glossy. Lunule not flattened and distinctly defined. Lower part of hind margin of shell somewhat angular. Anterior lateral tooth on the left valve and the corresponding depression on the right valve are characteristically striated .. .. *Meretrix.*

— Shell strongly sculptured with radial ribs and concentric grooves, the former being usually strongly tuberculated. Lunule flattened and well defined. Lower part of hind margin less distinctly angular. Hinge teeth normal .. .. .. *Gafrarium.*

5. Lunule distinct, flattened and often depressed to a varying degree, the proportion of its length to its breadth being variable. Profile of shell more or less rounded. Sculpture variable 6

— Lunule very indistinct, almost obsolete. Profile of shell angular, the concentric laminae on the surface being rendered correspondingly angular. Sculpture consisting of strongly crested, widely spaced concentric laminae .. .. *Venerupis.*

6. Shell rounded, about as high as broad, finely and sharply concentrically striated throughout, the striae being very close-set. Umbo small, pointed, strongly bent forwards like a curved beak. Pallial sinus pointed and angular .. .. *Dosinia.*

— Shell longer than high. Sculpture not as above. Umbo broader and less sharply pointed and *not* characteristically bent forwards as in the above. Pallial sinus usually rounded 7

7. Sculpture strongly developed, usually consisting of well raised, rather widely spaced, lamina-like ridges which are often strongly crested and with or without radial sculpture in addition 8

— Shell usually smooth, or sculpture, when present, very weak, consisting of growth lines only, or of concentric grooves with broad, flattened, interspaces between them which are not raised above the general surface of the shell 11

8. Shell small, triangularly ovate, only very slightly longer than high, either with widely spaced, erect, concentric laminae with smooth, deep interstices between them, or with a fine, close, reticulated sculpture in which the radial ridges tend to predominate .. .. .. *Chione.*

— Shell larger, the excess of the length over the height being relatively greater and well-emphasised. Sculpture consisting of strong, concentric, rather closely set crested laminae with radial ridges in the interstices, the concentric ridges, however, always predominating 9

9. Front part of the shell turned upwards. Hinge teeth widely diverging. Tooth in front of the cardinals in the left valve and corresponding hollow on the right valve small, but well developed and clearly seen. Pallial sinus relatively small .. *Antigona.*

— Front part of the shell normally rounded. Hinge teeth diverging at narrower angles. Tooth in front of the cardinals in the left valve and corresponding hollow on the right valve absent. Pallial sinus deeper 10

10. Radial ribs in the interestices between the concentric lamellae regularly disposed and uniformly well developed, though weaker and less raised than the concentric lamellae which are comparatively thin, but entire .. .. *Periglypta.*

— Radial ribs in the interstices between the concentric lamellae not well defined and sometimes well developed and clearly defined only on certain portions of the surface of the shell. Concentric lamellae thick, and often cut up into rows of tubercles .. .. *Venus.*

11. Anterior lateral tooth on the left valve and the corresponding depression on the right valve well developed 12

— Anterior lateral tooth on the left valve and the corresponding depression on the right valve absent 13

12. Lunule long, narrow, deeply depressed, margin of inner surface finely denticulated. Tooth in front of the cardinals elongate and almost horizontal in position. Area behind the umbo steeply sloping inwards .. .. *Sunetta.*

— Lunule short, broad, flattened, heart-shaped. Margin of inner surface smooth. Tooth in front of the cardinals normal and diverging from the cardinals at a narrower angle than in the above. Area behind the umbo not so well defined and sloping so steeply as in the above .. .. .. *Pitar.*

13. Lunule about one and a half to two times as long as broad and area behind the umbo not more than about three times as long as broad. Shell rather inflated and just a little longer than high. Hinge margin thick and with a characteristic triangular pit just behind the anterior adductor impression and in front of and beneath the cardinals .. .. *Catelysia.*

— Lunule much more than twice as long as broad and area behind the umbo greatly elongated, being about five to seven times as long as broad. Shell less inflated and much more elongated. Hinge margin thicker and the triangular pit behind the anterior adductor absent, its place being taken by a flattened impression 14

14. Hind margin of shell broad, more or less truncate, and sloping obliquely behind, meeting the hind end of the upper margin at a more or less well defined angle .. .. *Tapes.*

— Hind margin of shell narrow, evenly rounded, and leads on gradually to the upper margin, without forming a definite angle .. .. .. *Paphia.*

Genus **Circe** Schumacher, 1817.

Thiele includes this as a subgenus under the genus *Gafrarium.* The shell is rather flattened and compressed anteriorly. The umbo is angular and slightly anterior. The hinge margin is thick. The anterior lateral tooth is moderately elongated and low. The pallial line is only slightly sinuate.

This genus is represented at Krusadai by a single species, *Circe scripta,* which has also been recorded from Madras. It has been referred to in the previous published list of Krusadai Lamellibranchs (*Bull. Mad. Govt. Mus. Nat. Hist.*, I, No. 1, 1927, p. 99) as *Gafrarium (Circe) personatum* which is a synonym for *C. scripta.*

Circe scripta (Linné).

Plate XV, figs. 2*a* and 2*b*.

Venus scripta, Linné, Syst. Nat., Ed. X, 1758, p. 689.
Cytherea scripta and *C. undatina,* Lamarck, Anim. sans vert., V, 1818, p. 575.
Cytherea scripta, Hanley, Cat. Recent Bivalve Shells, 1843, p. 102.

Cytherea scripta, Catlow & Reeve, Conch. Nomencl., 1845, p. 40.
Circe scripta, Gray, Proc. Zool. Soc. London, 1847, p. 183.
Circe personata, Deshayes, Proc. Zool. Soc. London, 1853, p. 6.
Circe scripta, *C. fulgurata*, *C. personata* and *C. sugillata*, (non Jonas), Reeve, Conch. Icon., XIV, 1864, *Circe*, pl. i, figs. 1a to c; pl. ii, figs. 5, 6a to c; pl. iii, fig. 11.
Circe undatina, Angas, Proc. Zool. Soc. London, 1867, p. 922.
Circe scripta, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 141.
Circe scripta, Smith, Proc. Zool. Soc. London, 1891, p. 424.
Circe personata, Melvill & Standen, Journ, de Conchyl., IX, 1898, p. 83.
Circe scripta and var. *fulgurata*, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Circe scripta, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 292.
Circe scripta, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 134.
Circe scripta, Pelseneer, Siboga-Expeditie, "Lamellibranches" 1911, (Anat.), pl. xix, fig. 3.
Circe scripta, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 184 and 191.
Circe scripta, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, pp. 223-225.
Circe scripta, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V. No.1, 1941, p. 48.

This is a widely distributed species and has been described under several different names by various authors owing to the great deal of variation in the outline, sculpture and colouration of the shell. The shell is markedly flattened, moderately thin and evenly rounded anteriorly and ventrally, but the posterior margin is often more or less distinctly truncate and angular above. The sculpture is very characteristic, consisting of well marked closely set, fine, but strong concentric ridges some of which tend to cohere with each other towards the margins. The hinge area is fairly thick and extensive and bears three moderately diverging cardinal teeth in each valve and an anterior lateral tooth in front in the left valve and a corresponding hollow on the right. The umbo is small, compressed and flattened. The lunule is narrow, flattened and moderately elongate. The lunule and the area are coloured dark brown, sometimes with irregular chestnut markings. The pallial sinus is hardly sinuate. The impressions of the adductor muscles are very prominent and their outer margins are marked off as distinct, raised ridges. The inner surface of the shell is smooth and is bordered by a narrow, flattened, marginal area all round. The outer surface of the shell in most Krusadai specimens is pale yellowish brown or straw-coloured, often with numerous darker brown rather irregular and scattered, inverted V-shaped markings. Occasionally it is more or less uniformly brownish. The inner surface is tinged with different shades of purplish brown, but may sometimes be of a very pale, yellowish brown colour in the middle and almost whitish towards the periphery. The umbonal margin is sharply angular and the umbo is placed slightly anterior to the middle line. Kundugal Point, Pamban and Krusadai Island.

Genus **Gafrarium** (Bolten) Röding, 1798.

The shell is rounded or obliquely ovate, thick, with concentric and sometimes also radial sculpture. The lunule is flattened, elongated and narrow. The hinge area is short, always with three well separated cardinal teeth, the anterior lateral teeth being more or less elongated. The pallial line is not or only slightly sinuate.

This is a genus of thick-shelled, strongly sculptured clams and is represented at Krusadai by four species which may be distinguished as follows :—

1. Shell strongly radially ribbed, ribs strongly nodular, the nodules being well separated from one another except near the umbo. Concentric sculpture in the form of well defined grooves or ridges absent 2

— Shell much less strongly sculptured with faint, oblique or divaricating radial ridges and equally feebly developed or slightly stronger, close-set concentric ridges. Radial ridges not nodular .. 3

2. Nodules of the main radial ribs rounded or squarish and at least those of the middle ribs not well separated, especially above the middle line. Interstices between the ribs narrower than the ribs. Shell relatively more strongly inflated. Sculpture rather coarse-looking .. .. .. *G. tumidum.*

— Nodules of the main radial ribs dorso-ventrally compressed, more or less rectangular and well separated by deep transverse grooves. Interstices between the ribs as broad as, or even wider than the ribs. Shell less strongly inflated. Sculpture somewhat finer and less coarse-looking. .. *G. pectinatum.*

3. Shell with oblique radial ridges, which are well-developed and conspicuous only posteriorly, other oblique ridges divaricating from these anteriorly very faint, inconspicuous and almost disappearing except very near the anterior margin. Concentric ridges moderately strong. Shell marked only with scattered spots .. .. *G. dispar.*

— Shell with narrow, divaricating radial ridges which are more or less uniformly well developed throughout. Concentric ridges relatively weak. Shell marked with large, coalescing, reddish-brown inverted V-shaped markings .. .. *G. divaricata.*

Gafrarium tumidum Röding.

Plate XV, figs. 3*a* and 3*b*.

Gafrarium tumidum and *G. angulatum*, Röding, Mus. Boltenianum, 1798, pp. 176 and 177.
Cytherea gibbia, Lamarck, Anim. sans vert., V, 1818, pp. 577 and 578.
Circe gibbia and *C. Ronella*, Hanley, Cat. Recent Bivalve Shells, 1843, p. 108.
Circe gibbia, Sowerby, Thes. Conchyl., II, 1851, p. 649, pl. cxxxvii, figs. 4–7.
Circe gibbia, Fischer P., Journ. de Conchyl., VII, 1858, p. 337.
Circe gibbosa, Fraser, Proc. Zool. Soc. London, 1865, p. 196.
Circe gibbia, Adams A., Ann. & Mag. Nat. Hist., (4), III, 1869, p. 233.
Circe gibbia, Dunker, Index Moll. Mar. Japonicum, 1882, p. 202.
Circe gibbia, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 143.
Crista gibbia, Melvill & Sykes, Proc. Malacol. Soc. London, V, 1898, p. 47.
Circe (Crista) gibbia, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909 p. 138.
Circe gibbia, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 184 and 190, fig. 53.
Gafrarium tumidum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 231.

This is perhaps the commonest species of *Gafrarium* collected in the Pamban area. Both living specimens and dead shells are fairly abundant, particularly on the mud flats at Kundugal Point. It is a thick, solid, strongly inflated, ditry white shell with a very strong sculpture consisting of thick, nodular, radial ribs which tend to bifurcate on approaching the ventral margin, resulting in each rib being represented by a double row of nodules towards the ventral margin. The nodules are rounded and are well separated anteriorly and ventrally, being almost completely detached from each other, but dorsally, posteriorly and towards the umbo the nodules are only imperfectly separated by shallow grooves. In the interstitial spaces between some of the main ribs are secondary rows of nodules running up from the ventral marign and reaching up to varying levels below the middle of the surface. In the posterior one-fifth part of the surface, these regular radial ribs are replaced by oblique nodular ribs which divaricate sharply away from the direction of the main plan of radiating sculpture, and reach the posterior margin. The lower part of the hind margin is somewhat truncated. The tooth and hollow in front of the cardinals are well developed. The pallial line is entire. The inner surface of the shell is smooth, glossy and whitish, blotched with deep purplish brown posteriorly, and its lower margin is dentated. The outer surface is white for the most part, but often marked with irregular dark spots posteriorly and near the umbo. Kundugal Point, Pamban, Krusadai and Shingle Islands.

Gafrarium pectinatum (Linné).

Plate XV, figs. 4*a* and 4*b*.

Venus pectinata, Linné, Syst. Nat., Ed. X, 1758, p. 689.
Cytherea pectinata, Lamarck, Anim. sans vert., V, 1818, p. 577.
Cytherea pectinata, Sowerby, Cat. Tankerville, 1825, p. 13.
Cytherea pectinatum, Catlow & Reeve, Conch. Nomencl., 1845, p. 39.

Circe pectinata, Sowerby, Thes. Conchyl., II, 1851, p. 649, pl. cxxxvii, figs. 1–3.
Circe pectinata, Fischer, P., Journ. de Conchyl., XVIII, 1870, p. 371.
Circe (Crista) pectinata, Smith, Proc. Zool. Soc. London, 1891, p. 424.
Crista pectinata, Shopland, Proc. Malacol. Soc. London, XXVII, 1899, p. 194.
Crista pectinata, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 293.
Circe (Crista) pectinata, Lynge, Marine Lamellibarnchiata of the Danish Expedition to Siam, 1909, p. 138.
Gafrarium pectinatum, Trans. Zool. Soc. London, XXVI, 1927, p. 306.
Gafrarium pectinatum, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 230.

The figures given by Reeve as *G. pectinata*, (Conch. Icon., XIV, 1863, *Circe*, pl. v, figs. 20 *a* and c) are correctly those of *G. tumidum*. The present species is closely allied to the preceding one and it is often difficult to separate worn shells of the two species. The shell resembles that of *G. tumidum* in its plan of radial sculpture, size and disposition of the hinge teeth and in the general shape and proportions of the valves. But the sculpture, on the whole, is decidedly finer and the radial ribs are more clearly marked, being separated by well defined, clear-cut interspaces which are slightly broader than the ribs themselves. The nodules in the unbifuracated portions of the ribs are compressed and somewhat transversely elongated. As in the preceding species there are secondary ribs in the interstitial spaces made up of a single row of rounded nodules, some of these reaching up to a point far above the middle of the shell. The shell is relatively less strongly inflated and not produced posteriorly as much as in *G. tumidum* and more broadly rounded in front. The inner surface of the shell is smooth and white, except for two thick, purplish brown streaks one on either side of the hinge teeth. On the outside, the shell is whitish, except posteriorly and towards the umbo where there are a few, irregular reddish brown markings. Pamban, Kundugal Point, Krusadai and Shingle Islands.

Gafrarium dispar (Chemnitz).

Plate XV, figs *5a* and *5b*.

Venus dispar, Chemnitz, Conch. Cab., XI, 1795, p. 230, pl. cciii, figs. 1981 and 1982.
Venus dispar and *V. discors*, Dillwyn, Descr. Cat., I, 1817, p. 199.
Cytherea dispar, Hanley, Cat. Recent Bivalve Shells, 1843, p. 103.
Cytherea dispar, Catlow & Reeve, Conch. Nomencl., 1845, p. 37.
Circe dispar, Sowerby, Thes. Conchyl., II, 1851, p. 650, pl. cxxxvii, figs. 10 and 11 ; pl. clxiii, figs. 53 and 54.
Circe dispar, Fischer, P., Journ. de Conchyl., VII, 1858, p. 108.
Circe dispar and *C. marmorata*, Reeve, Conch. Icon., XIV, 1863, *Circe*, pl. vi, figs. 24 a, b ; pl. viii, fig. 30.
Circe dispar, Adams, A., Ann. & Mag. Nat. Hist. (4), III, 1869, p. 232.
Circe dispar, Index Moll. Mar. Japonicum, 1882, p. 202.
Circe (Crista) dispar, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 139.
Gafrarium dispar, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 230.

The shell of this species is easily distinguished from those of the two preceding species by its characteristic sculpture which is much weaker, consisting of moderately close-set, concentric ridges and oblique, divaricating radial ridges, the latter being conspicuous only in the posterior part of the shell. At the extreme posterior area of the surface, the concentric ridges lose their distinctness. The radial ridges divaricate like the two limbs of

an inverted 'V', the apices of these V's being placed in a regular line, but their anterior limbs, immediately on leaving the apex, become inconspicuous and almost completely disappear, being in evidence again only at the extreme anterior part of the shell where they are seen as faint, upwardly curved ridges. Near the posterior part of the ventral margin, some of these concentric ridges get cut up into faint, indistinct nodules by the interception of oblique divaricating ridges. The anterior and posterior margins of the shell are more or less similarly rounded and the umbo is more centrally placed than in the preceding species. The hinge teeth are thinner and slightly more narrowly diverging. The lunule is well defined, elliptical and usually of a uniform dark brown colour. The area behind the umbo is large, steeply sloping inwards and marked with widely spaced, purplish, transverse lines. The inner surface of the shell is smooth throughout, but denticulated at the margin. It is white, but may be occasionally tinged with brown near the umbo. The outer surface is of a pale yellowish white colour, dotted all over with orange-red or brownish spots, some of which sometimes tend to coalesce forming zig-zag markings. Pamban, Krusadai and Shingle Islands.

A variety of the above species, *G. dispar* var. *abbreviata* is represented in the Museum collection by a single shell collected at Pamban. It is readily distinguished from *G. dispar s. str.* by the shell being relatively more strongly inflated and by the antero-posterior axis of the shell being much shortened, so as to almost equal the length of the dorso-ventral axis.

Gafrarium divaricata (Chemnitz).

Plate XVI, figs. 1*a* and 1*b*.

Venus divarciata, Chemnitz, Conch. Cab., VI, 1782, p. 317, pl. xxx, fig. 316.
Cytherea divaricata, Lamarck, Anim. sans vert., V., 1818, p. 578.
Cytherea divaricata, Deshayes, in Lamarck, Anim. sans vert., Ed. II, Vol. VI, 1835, p. 324.
Cytherea divaricata, Hanley, Cat. Recent Bivalve Shells, 1842, p. 108.
Circe aequivoca, Sowerby, Thes. Conchyl., II, 1855, p. 650, No. 4, pl. 137, figs. 12–15 (non No. 3, *C. divaricata*).
Circe divaricata, Reeve, Conch. Icon., XIV, 1863, pl. vi, figs. 23a and 23d.
Crista divaricata, Dautzenberg & Fischer, Journ. de Conchyl., LIII, 1905, p. 458.
Circe (Crista) divaricata, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 139.

The shell is larger and thicker than in any of the preceding species of *Gafrarium*, but with a relatively weak sculpture, consisting of concentric and divaricating radial ridges, but in this species the latter are developed uniformly both anterior and posterior to the line of divarication. The concentric ridges, however, tend to lose their distinctness posteriorly. There are also a few specially well marked concentric growth lines at somewhat wide intervals. The points at which the radial ribs divaricate do not all lie on the same oblique line as in *G. dispar*, but tend to shift their positions a little to the front as the

ventral margin is approached. The decussating of the radial and concentric ridges gives the sculpture a closely reticulated appearance, especially in the anterior half of the shell, but most of the dead shells washed up on the beach are worn to a varying degree and sculptural details are difficult to make out. Yet they may be readily distinguished by their characteristic colouration, remnants of which persist even in badly worn shells. The outer surface is pale yellowish or whitish, profusely ornamented with reddish brown angular markings with their apices turned towards the umbo. This pattern is often supplemented by brownish radial lines extending inwards to a little distance from the margin. They are fewer and widely set in the ventral and ventro-lateral margins of the shell and more numerous and close-set in the upper portions of the anterior and posterior margins. The inner surface is smooth and white. The margin of the shell is thick, and in the adult, often consists of several superimposed growth layers. This species is fairly common on the Indian coast and has been recorded from the Madras area as well. Shingle Island.

Genus **Meretrix** Lamarck, 1799.

This genus includes the thick-shelled backwater clams. The shell is triangularly ovate, thick, usually smooth, sometimes weakly concentrically sculptured. The lunule is not well defined, and the ligament is usually short. The hinge area is thick, always bearing three grooved cardinal teeth. The lateral teeth are stout ; the anterior lateral tooth of the left valve and the corresponding depression in the right valve are characteristically striated. The pallial sinus is very feebly developed.

A single species, *Meretrix casta*, is represented in the Museum collection of bivalves from Krusadai Island. This species is better represented in the Madras area, where numerous living specimens have been collected from around the backwaters at Adyar and Ennur.

Meretrix casta (Chemnitz).

Plate XVI, figs. 2*a* and 2*b*.

Venus casta, Chemnitz, Conch. Cab., VI, 1782, p. 349, pl. 33.

Cytherea casta, Lamarck, Anim. sans vert., Ed. II, Vol. VI, 1835, p. 301.

Meretrix casta, Romer, Monographie der Molluskengattung *Venus* Linné, Band I, subgenus *Cytherea*, 1869, p. 31, pl. xii, fig. 2.

Corbicula (*Velorita*) *satparensis*, Preston, Rec. Ind. Mus., X, 1914, p. 306.

Meretrix casta, Preston, ibid., XI, 1915, p. 300 (the large valve, 67 mm. x 73 mm. is *Meretrix meretrix*).

Meretrix casta, Annandale & Kemp, Mem. Ind. Mus., V, (4), 1916, pp. 351–352.

Meretrix casta, Hornell, Rec. Ind. Mus., XIII, 1917, p. 166.

Meretrix casta, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 184, 188 and 192.

Meretrix casta, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 50.

Hornell includes *M. ovum*, a form occuring on the west coast, in the synonymy of *M. casta*, but as it is easily distinguished by its more elongated shell, it is generally separated

as a distinct species. *M. casta* is characterised by a thick, moderately large shell generally attaining a length of about an inch and a half, with a brown horny periostracum when fresh, but smooth and devoid of sculpture. The hinge margin is thick and bears three cardinal teeth and a tooth in front of the cardinals on the left valve and a corresponding depression on the right. The lunule is not well defined and is almost obsolete. The shell is triangularly ovate or cordate, longer than high and moderately inflated. The front margin is evenly rounded, but the lower part of the hind margin is somewhat angular. The pallial line shows only a very slight indentation below the posterior adductor impression. The inner surface is white and glossy, but the area bounded by the pallial line tends to be pale yellowish white and the posterior margin is bright purplish brown. The outer surface is pale yellowish brown, tinged with dark grey posteriorly and very faintly rayed with greyish radial lines. As this is a backwater species the specimens are most commonly found on the extensive mud flats at Kundugal Point, generally at considerable distances away from the shore line, in company with living specimens of the more abundant Venerid, *Catelysia opima* to which the present species shows a strong superficial resemblance. The shell is subjected to considerable variation in form, thickness and development of the hinge elements. Pamban and Kundugal Point.

Genus **Pitar** E. Romer, 1857.

(Syn. **Caryatis** E. Romer, 1862).

The shell is ovate or triangularly rounded, smooth or concentrically striated. The lunule is not depressed. The hinge margin often bears a groove-like depression beneath the right anterior cardinal tooth.

This genus includes fairly large-sized shells, either strongly or moderately inflated and with or without definite sculpture in the form of strong concentric grooves. Three species, *P. alabastrum*, *P. erycina* and *P. nobilis* have been recorded from the Pamban area. Of these the first two are represented also at Madras. The three Pamban species of *Pitar* may be distinguished as follows :—

1. Shell rather thin, but strongly inflated. Sculpture weak and irregular, the surface being very faintly concentrically striated .. .. .. *P. alabastrum.*

— Shell thicker and less strongly inflated. Sculpture strongly developed, more or less regular and well defined, consisting of strong, close-set concentric ridges 2

2. Shell white, without colour markings, length of shell only slightly exceeding its height. .. .. *P. nobilis.*

— Shell brightly coloured being bright orange-brown in colour with several broad radiating dark chestnut-brown bands diverging from the umbo. Length of shell proportionately much greater than the height .. .. *P. erycina.*

Pitar alabastrum (Reeve).

Plate XVI, fig. 3.

Dione alabastrum Reeve, Conch. Icon., XIV, 1864, *Dione*, pl. x, fig. 42.
Pitar alabastrum, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 50.

The shell is large, white, somewhat thin and rather strongly inflated with the umbo markedly inclined forwards. The shell is distinctly longer than high, with an evenly rounded margin all round. The strong forward inclination of the umbo and the consequent depression in front of the umbo results in the front margin being much narrower than the hind one. The outer surface of the shell is rather coarse, and is traversed by faint, irregular concentric striae, which, however, do not form any definite sculptural pattern. The hinge teeth are solid, the tooth in front of the cardinals being specially well developed and the posterior lateral tooth narrow and much elongated. The lunule is well defined and somewhat depressed. The adductor impressions are well marked and even slightly raised. The pallial line is deeply sinuate. The inner surface is smooth, glossy and pure white throughout, except over the region of the muscle impressions which bear a slight brownish tinge. The outer surface is also white, but very faint scattered light brown markings can be made out in the shells examined. Only dead shells have been collected so far from Pamban. This species has also been recorded from Madras. Pamban.

Pitar erycina (Linné).

Plate XVI, figs. 4*a* and 4*b*.

Venus erycina, Linné, Syst. Nat., Ed. XII, 1767, p. 1131.
Cytherea erycina, Lamarck, Encyclopédie Méthodique, Vers. V, 1797, pl. 264, fig. 2.
Cytherea erycina, Catlow & Reeve, Conch. Nomencl., 1845, p. 38.
Callista erycina, Chenu, Man. de Conchyl., II, 1862, p. 87, fig. 383.
Dione erycina, Reeve, Conch. Icon., XIV, 1864, *Dione*, pl. i, fig. 3.
Crista erycina, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 184.
Pitar erycina, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 50.

The shell is thicker and somewhat less strongly inflated than in the preceding species. The umbo is inclined forwards, but to a less extent than in *P. alabastrum*, but the general shape of the profile and proportions of the length and height are much the same as in that

species. The surface of the shell is traversed by strong concentric grooves with moderately broad, flattened spaces intervening between them. These interspaces slope slightly downwards at their posterior margins, and those towards the ventral margin of the shell tend to take the form of definite, raised ridges as a result of the intervening grooves widening considerably over this region. The characters of the lunule, hinge teeth and pallial sinus are more or less the same as in the preceding species. The anterior adductor impression tends to be slightly depressed. The inner surface is smooth, pale yellow within the pallial line, and bluish white outside it. The outer surface is pale brown, tinged with orange-red towards the anterior and ventral margins, and conspicuously rayed with radially widening dark or chocolate brown bands of varying widths diverging from the umbo. The area behind the umbo and the area immediately surrounding the lunule are traversed by widely spaced brown stripes. This is one of the most brightly coloured species of *Pitar* and is widely distributed in the Indo-Pacific Region. Only dead shells have so far been collected from Pamban. Shells of this species collected in Ceylon are frequently sold in the shell bazaar at Rameswaram owing to their attractive colouration. Pamban.

Pitar nobilis (Reeve).

Plate XVII, figs. 1*a* and 1*b*.

Cytherea nobilis, Reeve, Proc. Zool. Soc. London, 1849, pt. ii, p. 126.
Dione nobilis, Reeve, Conch. Icon., XIV, 1864, *Dione*, pl. iv, fig. 15.

A single left valve of the shell of this species collected at Pamban is represented in the collection. The shell is fairly thick and large, measuring over 60 mm. in length and about 50 mm. in height. The umbo is more strongly inclined forwards than in the preceding species. The outline of the shell is more or less triangularly heart-shaped and the front margin is far more narrowly rounded than the hind margin. The shell bears a characteristic sculpture, consisting of strongly developed, close-set concentric ridges which are slightly flexed here and there and are consequently not strictly parallel throughout. Towards the front margin the ridges converge and many of them coalesce with each other. In fresh specimens the surface is covered with a thin, glossy, horny, pale brown periostracum. The hinge teeth, lunule and pallial sinus are similar to those of the preceding species. The anterior adductor impression is slightly depressed. The shell is uniformly whitish throughout both on the outside and in the interior. The single valve in the collection, however, bears traces of an ashy grey colour on the inner surface, but this colour is apparently secondary, due to impregnation of dark, sandy material. Reeve mentions the locality of this species as California, but it is also represented on the Indian shores. Pamban.

Genus **Sunetta** Link, 1807.

(Syn. **Meröe** Schumacher, 1817.)

The shell is more or less elongately ovate, thick, smooth or concentrically sculptured. The lunule is small and the ligamentary area depressed. The hinge margin always bears three cardinal teeth, and the anterior lateral tooth is moderately elongated. The pallial sinus is shallow and somewhat angular. The margin is toothed.

A single species, *S. scripta*, which is also represented at Madras, has been recorded from Pamban.

Sunetta scripta (Linné).

Plate XVII, figs. 2*a* and 2*b*.

Donax scripta, Linné, Syst. Nat., Ed. X, 1758, p. 683.
Donax scripta, Linné, Syst. Nat., Ed. XII, Vol. II, 1767, pp. 1127, 109.
Cuneus scriptus, Rumphius, Mus. Amb., 1739, pl. 43, fig. 1. m.
Meröe scripta, Reeve, Conch. Icon., XIV, 1864, *Meröe*, pl. ii, figs. 6*a* and *b*.
Sunetta scripta, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 50.

The shell is smooth and glossy, moderately elongated, evenly rounded in front and obliquely truncated behind, the junction of the posterior and ventral margins being rather angular. The hinge teeth are thin and narrow and the tooth in front of the cardinals in the left valve and the hollow in the right are considerably elongated. The lunule is long, narrow and deeply excavated. The area behind the umbo is also deeply sunk. The sites of the adductor impressions are marked by slight depressions on the inner surface, and the pallial line is deeply sinuate. The inner surface is smooth and uniformly whitish and its margin is finely crenulated all round. The outer surface is also entirely smooth and polished, but bears a bright colour pattern which is subject to variation. It is generally pale yellowish or fleshy white, marked all over with purplish arrow-head-shaped markings which may either be very numerous and close-set or few and far apart. *S. meröe* is another common South Indian species recorded from Madras, readily distinguished from the present species by the shell being strongly concentrically grooved, but this has not so far been collected from Pamban. Pamban.

Genus **Dosinia** Scopoli, 1777.

The shell is rounded, more or less strongly compressed, with concentric sculpture. The lunule is usually small and depressed and the ligament sunk. The hinge margin is thick, always with three cardinal teeth, and the left valve with a more or less well developed anterior lateral tooth ; the right posterior tooth is grooved and the left posterior elongated and oblique.

Five species of *Dosinia* have been recorded from the Pamban area; they may be distinguished as follows :—

1. Concentric ridges strongly raised, laminated, the laminae being inclined towards the umbo and somewhat widely spaced with broad interspaces between them .. .. *D. histrio.*

—Ridges not as above 2

2. Shell rather strongly inflated, posterior margin evenly rounded and not angular about the middle. Front margin not forming angular shoulder in front of the lunule. Lunule superficial, large, elongate, more or less obsolete .. .. *D. trigona.*

—Shell more flattened, posterior margin angular about the middle, front upper angle well developed and forming a more or less prominent shoulder in front of the lunule. Lunule short, clearly defined and depressed 3

3. Ridges somewhat coarse, tending to be slightly crested towards the anterior and posterior margins and, though close-set, are separated by fairly deep grooves. Portion of hind margin above the middle angle more or less straight. Surface of shell rather dull .. .. *D. puella.*

—Ridges much finer and very closely set, not crested anywhere, uniformly developed throughout. Grooves separating the ridges shallow. Portion of the hind margin above the middle angle rather arched. Surface of shell slightly glossy 4

4. Angle between the lunule margin and the posterior cardinal tooth somewhat obtuse .. .. *D. modesta.*

—Angle between the lunule margin and the posterior cardinal tooth approximately a right angle .. *D. cretacea.*

Dosinia histrio (Gmelin).

Plate XVII, fig. 3.

Venus histrio, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3387.
Venus australis, Quoy & Gaimard (non Gmelin), Voy. " Astrolabe ", III, 1834, p. 528.

Cytherea histrio, Hanley, Cat. Recent Bivalve Shells 1843, p. 103.
Cytherea histrio, Catlow & Reeve, Conch. Nomencl., 1845, p. 38.
Artemis variegata, Reeve, Conch. Icon., VI, 1850, *Artemis*, pl. vi, figs. 33*a* to *c*.
Artemis variegata, Sowerby, Thes. Conchyl., II, 1852, p. 675, pl. clxiv, fig. 81.
Dosinia variegata, Fischer, P., Journ. de Conchyl., VII, 1858, p. 337.
Dosinia scabra, Adams, A., Ann. & Mag. Nat. Hist., (4) III, 1869, p. 233.
Dosinia histrio, Dunker, Index Moll. Mar. Japonicum, 1882, p. 204.
Dosinia histrio, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 293.
Dosinia histrio, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 835.
Dosinia (*Austrodosinia*) *histrio*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 244.

This species is widely distributed in the Indo-Pacific Region, but only a few dead shells have been collected from Pamban. The shell is readily distinguished by its concentric ridges being more strongly raised, laminated and more widely spaced than in any of the remaining species of *Dosinia* recorded from Pamban. The laminae or crests on the ridges are well developed and are inclined towards the umbo. The interspaces between the ridges are wide and regularly developed. The lunule is small, brownish, slightly depressed and heart-shaped. The posterior margin of the shell is angular in the middle, the portion of the margin above it being rather straight and the portion below evenly rounded and leading on to the ventral margin. The front shoulder is short, but fairly prominent. The pallial sinus is deeply and angularly sinuate as usual. The shell is whitish, rayed with broad, brownish, radial bands which may be seen through from the inner surface also, especially towards the ventral margin. The shells are rather variable in the form of their sculpture. Pamban.

Dosinia modesta (Sowerby).

Plate XVII, figs. 4*a* and 4*b*.

Cytherea modesta, Sowerby, Proc. Zool. Soc. London, 1835, p. 47.
Cytherea modesta, Catlow & Reeve, Conch. Nomencl., 1845, p. 39.
Artemis modesta, Reeve, Conch. Icon., VI, 1851, *Artemis*, pl. ix, fig. 54.
Dosinia prostrata var. *modesta*, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 50.

This is by far the commonest species of *Dosinia* represented in the Pamban area. The shell is moderately thick and slightly inflated, rounded and whitish, with a prominent, forwardly directed umbo. The shell is very finely, yet strongly, concentrically striated. These concentric ridges are so fine, regular, close-set and uniformly developed that they give an almost glossy finish to the surface of the shell. The shell is rounded and about as high as long. The shoulder in front of the umbo is more or less well defined and forms a rather blunt angle where it meets the front margin. The posterior margin is angular about the middle, the position of this angle varying slightly in different shells. The lunule is deeply depressed and heart-shaped. The hinge teeth are moderately thin and widely diverging. The tooth in front of the cardinals in the left valve is small and triangular. The pallial sinus is very deep and sharply V-shaped as usual in this genus. This species

has been treated as a variety of *D. prostrata* by Dr. Gravely in his paper on Madras Shells (*loc. cit.*) but, as the characters of the two forms are sufficiently distinctive so far as the Pamban shells are concerned, it has been considered advisable to treat this as a separate species in the present account. *Dosinia prostrata s. str.* which has been recorded from the Madras area, has not yet been collected at Pamban. Kundugal Point and Pamban.

Dosinia cretacea (Reeve).

Plate XVII, figs. 5*a* and 5*b*.

Artemis cretacea, Reeve, Conch. Icon., VI, 1851, *Artemis*, pl. vi, fig. 35.
Artemis cretacea, Sowerby, Thes. Conchyl., II, 1852, p. 667, pl. cxlii, fig. 51.
Dosinia prostrata var. *cretacea*, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51.

A single, moderately large shell from Pamban, with both the valves intact, is represented in Mr. Crichton's collections. The shell is fairly thick, rounded and about as high as long. The umbo is strongly bent forwards and beak-like, the lunule deeply depressed and heart-shaped and the front shoulder anterior to the lunule is prominently developed. The hind margin of the shell is markedly angular near the middle. The surface of the shell is very finely and closely, concentrically striated, the striae being coarser and more strongly raised towards the front and hind margins. The striae are extremely fine towards the umbo, rendering this part of the surface almost glossy. The shell resembles that of the preceding species in almost all details, except in the disposition of the hinge teeth. They are well developed and moderately diverging. The angle between the posterior cardinal tooth and the hinge margin is approximately a right angle in this species, whereas in the preceding species this angle is wider and definitely an obtuse angle. The area of the ligament is elongated and sharply depressed. The shell is whitish with a slight creamy brown tinge. The single shell in Mr. Crichton's collection measures 32 mm. long and 31 mm. high. Pamban.

Dosinia trigona (Reeve).

Plate XVII, figs. 6*a* and 6*b*.

Artemis trigona, Reeve, Conch. Icon., VI, 1851, *Artemis*, pl. vii, fig. 42.
Cytherea trigona, Sowerby, Thes. Conchyl., II, 1852. p. 633, pl. 133, fig. 120.
Artemis trigona, Sowerby, ibid., p. 659, pl. 141, fig. 20.
Dosinia trigona, Romer, Monographie d. Molluskengatt., *Dosinia*, 1862, p. 20, pl. iv, fig. 5.
Dosinia trigona, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 152.
Dosinia trigona, Dautzenberg, Journ. de Conchyl., LXVIII, 1923, p. 66.

The shell is readily distinguished from those of the preceding species by the more acutely triangular shape of the upper part, by being more strongly inflated and by the lunule being very large, superficial and almost obsolete. The margin of the shell is evenly rounded throughout and not markedly angular behind as in the preceding species. The

sculpture consists of numerous concentric ridges but these are neither so fine and close-set nor so uniformly developed as in the two preceding species. The tooth in front of the cardinals in the left valve is small and somewhat bluntly conical. The pallial sinus is deep and bluntly V-shaped. The shell is whitish, tinged with a pale yellowish brown colour on the outer surface. The surface of the shell presents a slightly coarser appearance than in *D. modesta*. Pamban.

Dosinia puella Angas.

Plate XVII, figs. 7*a* and 7*b*.

Dosinia puella, Angas, Proc. Zool. Soc. London, 1867, p. 923.

The shell is moderately small, just as high as long, with an almost perfectly circular margin except for the rather sharp angle about the middle of the posterior margin and the well developed angular front shoulder. The valves are moderately inflated, the degree of convexity of the valves being intermediate between that of *D. modesta* and *D. trigona*, in proportion to the size of the shell. The concentric ridges are strong, well raised, somewhat crested towards the anterior and posterior margins and separated by deep, narrow grooves. The lunule is small, distinct, depressed and heart-shaped. The tooth in front of the cardinals in the left valve is small and elongate. The pallial sinus is deep and more or less sharply V-shaped. The surfaoe of the shell is pale yellowish brown and tinged with a slightly deeper shade of the same colour towards the umbo. Pamban.

Genus **Venus** Linné, 1758.

The shell is usually thick, rounded or ovate, as a rule with well developed concentric sculpture, sometimes also radial sculpture. The lunule is well defined and the hinge margin thick, always with three diverging cardinal teeth, the anterior lateral tooth being usually reduced. The pallial sinus is moderately small. The margin of the inner surface is finely toothed.

Four species of *Venus* have been recorded from Pamban. They may be distinguished as follows :—

1. Shell small, not markedly inflated, comparatively thin, radial ridges predominating throughout or at least towards the anterior and posterior margins 2

—Shell large, inflated, thick, both concentric and radial sculpture present, but the concentric ribs definitely predominating over the radial ones. Sculpture appearing more or less reticulated .. 3

2. Radial ridges present towards the anterior and posterior margins, and concentric ridges in the intervening region	*V. arakana.*
—Radial ridges present throughout the surface and decussated by weaker concentric ridges	*V. imbricata.*
3. Concentric laminae thin and somewhat widely spaced. Shell with broad, brownish radial bands each consisting of a series of angular patches with their apices pointing towards the umbo. Hinge teeth whitish	*V. chemnitzii.*
—Shell thicker, concentric ridges much stouter, coarser and more close-set, the intervening groups being deep. Shell with radially disposed brownish spots and linear markings. Hinge teeth of a bright orange-red colour	*V. reticulata.*

Venus reticulata Linné.

Plate XVIII, figs. 1*a* and 1*b*.

Venus reticulata, Linné, Syst. Nat., Ed, X, 1758, p. 687.
Venus corbis, Lamarck, Anim. sans vert., 1818, p. 585.
Venus reticulata and *V. corbis*, Sowerby, Cat. Tankerville, 1825, p. 14.
Venus reticulata, Hanley, Cat. Recent Bivalve Shells, 1842, p. 110 ; (Supplement, 1856, pl. xvi, fig. 9).
Venus reticulata, Catlow & Reeve, Conch. Nomencl., 1845, p. 35.
Venus reticulata, Sowerby, Thes. Conchyl., II, 1853, p. 706, pl. cliii, figs. 11–13.
Venus reticulata, Fischer, P., Journ. de Conchyl., LVII, 1858, p. 337.
Venus reticulata, Chenu, Man. de Conchyl., II, 1862, p. 82, fig. 337.
Venus reticulata, Reeve, Conch. Icon., XIV, 1863, *Venus*, pl. x, fig. 34.
Venus reticulata, Smith, Proc. Zool. Soc. London, 1891, p. 424.
Venus reticulata, Smith, Fauna and Geography of the Maldive and Laccadive Archipelagoes, II, 1903, p. 625.
Chione reticulata, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 156.
Venus reticulata, Pelseneer, Siboga-Expeditie, Lamellibranches (Anat.), 1911, p. 53.
Venus reticulata, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 184.
Antigona reticulata, Prashad, Siboga-Expeditie, Pelecypoda, Monogr, CXVIII, 1932, p. 249.

This species is well represented in the Pamban area. Numerous dead shells have been collected on the beach, especially on Shingle Island. The shell is thick, solid and closely reticulately sculptured throughout, with strong, close-set, concentric, crenulated ridges and with weaker radial ridges in the interstices between them. The surface consequently presents a coarse, almost tuberculated appearance. The hinge is thick, and bears three stout cardinal teeth, the middle one of which is distinctly bifid. The hinge area is of a characteristic bright orange-red colour. The tooth in front of the cardinals in the left valve and the hollow in the right are entirely absent. The pallial sinus is broad and U-shaped. The shell is

white, marked with brown spots and blotches which tend to be arranged radially. The front margin of the shell is rounded and narrower than the broad and truncated hind margin. The reticulated sculpture of the shell and the orange colour of the hinge teeth are very characteristic of this species and help to distinguish even worn-out shells washed upon the beach or lodged among the shingle on the reefs. Shingle Island and Pamban.

Venus chemnitzii Hanley.

Plate XVIII, figs. 2*a* and 2*b*.

Venus chemnitzii, Hanley, Proc. Zool. Soc. London, 1844, p. 169.
Venus chemnitzii, Reeve, Conch. Icon., XIV, 1864, *Venus*, pl. x, fig. 32.

The shell closely resembles that of the preceding species and is easily mistaken for it, but is much rarer in the Pamban area whence only two valves, a right and a left, are represented in the Museum collection. The shell may be easily distinguished from that of *V. reticulata* by its concentric laminae being thinner and more widely spaced and by the hinge teeth being thinner and devoid of any trace of the orange colour so characteristic of that species. The concentric laminae are thin, erect and closely folded on their lower surfaces, the concavity of these folds facing away from the umbo. The interspaces between these laminae are moderately wide, flattened and traversed by close-set, narrow radial ridges. The hinge teeth are disposed much as in *V. reticulata*, but are thinner and the middle cardinal tooth is not bifid. The pallial sinus is deep and angular at the apex. The shell is whitish, or very pale yellowish and rayed with three or four broad, radial bands, each consisting of a series of brownish patches, triangular towards the umbo and squarish ventrally, the latter often coalescing with each other. The margin of the inner surface is minutely crenulated. Pamban.

Venus arakana (G. & H. Nevill).

Plate XVIII, fig. 3.

Cryptogramma arakana, Nevill, G. & H., Journ. Asiatic Soc. Bengal, XL (2), 1871, p. 10, pl. i, figs. 16, 16a.
Venus arakana, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51.

The shell is small, triangularly ovate, distinctly longer than high, with an evenly rounded front margin, and the oblique dorso-lateral and ventro-lateral margins meeting posteriorly at a more or less sharp angle. The sculpture of this species is interesting in that it varies in the different portions of the shell. In the middle, the surface presents a closely latticed appearance owing to the decussation of strong, close-set concentric ridges and more closely set radial grooves which are more in evidence in the interstitial spaces between the ridges than on the ridges themselves. The latter, however, tend to get slightly constricted each into a contiguous series of rounded or squarish nodules. At the extreme

anterior side, there are four or five strong radial ribs, each consisting of a series of large rounded granules which are formed by the cutting up of the concentric ridges by deep radial grooves. Again, posteriorly there are similar radial ribs, but in this region they are more numerous and slightly more widely spaced. The hinge teeth are fine and diverge at more or less equal angles. The pallial sinus is moderately deep, broad and U-shaped. The margin of the inner surface is finely denticulated throughout its extent. The shell is whitish, slightly tinged with pale brown in the middle. Pamban.

Venus imbricata Sowerby.

Plate XVIII, figs. 4*a* and 4*b*.

Venus imbricata, Sowerby, Thes. Conchyl., II, 1853, p. 715, No. 36, pl. 156, figs. 81–82.
Venus imbricata, Reeve, Conch. Icon., XIV, 1863, *Venus*, pl. xxiv, fig. 118.
Venus imbricata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51.

A large number of empty shells of this species was obtained in a dredge collection between Krusadai and Shingle Islands in September, 1948, but strangely enough it had not been previously recorded from Krusadai. It is a common species at Madras, where large numbers of dead shells are frequently found thrown up on the beach. The shell is small and resembles more or less that of *V. arakana* in general appearance. It is triangularly ovate, with the posterior margin somewhat produced. The umbo is fairly well developed and distinctly inclined forwards, but the lunule and the area behind the umbo are only slightly depressed and not well defined. The sculpture is very strong and well marked, consisting of strong, well developed radial ridges which are decussated by weaker concentric ridges. The sculpture is therefore more or less reticulated, but the radial ridges predominate throughout. The concentric ridges are thin and lamina-like and present a rather crested appearance when examined closely. The shell is whitish or pale purplish brown, usually with a well marked deep purplish ray extending from the umbo along the posterior margin. The interior of the shell is smooth, white and polished, but its margin is finely toothed in correspondence with the external radial ridges. The shell measures about 12 mm. long and 10 mm. high on the average. Krusadai Island.

Genus **Antigona** Schumacher, 1817.

The shell is ovate, with radial ribs and strong concentric lamellae. The lunule and ligamentary area are clearly defined. The cardinal teeth are widely diverging. The pallial sinus is small and acutely angular.

Thiele includes *Antigona* as a sub-genus under *Venus*, but I have followed Prashad in treating it as a separate genus as its diagnostic characters are sufficiently distinctive.

This genus is represented at Pamban by a single species, *A. lamellaris*, which is the genotype of *Antigona*.

Antigona lamellaris Schumacher.

Plate XVIII, figs. 5*a* and 5*b*.

Antigona lamellaris, Schumacher, Essai, Nouv. Syst., 1797, p. 155, pl. xiv, figs. 2, 2*a*.
Venus reticulata, var. Q., Lamarck, Anim. sans vert., V, 1818, p. 585.
Venus subrostrata, Reeve, (non Lamarck), Conch. Syst., 1841, p. 93, pl. lxviii, fig. 4.
Venus Lamarckii, Catlow & Reeve, Conch. Nomencl., 1845, p. 34.
Venus Lamarckii and *V. nodulosa*, Sowerby, Thes. Conchyl., II, 1853, p. 707, pl. cliii, figs. 20, 21 ; p. 708, pl. cliii, fig. 16.
Venus Lamarckii, Reeve, Conch. Icon., XIV, *Venus*, 1863, pl. xii, figs. 39 *a* and *b*.
Venus Lamarckii, Mitchell, Cat. Mus. Madras, 1867, p. 64.
Venus lamellaris, Dunker, Index Moll. Mar. Japonicum, 1882, p. 196.
Venus (*Antigona*) *lamellaris*, Smith, " Challenger ", Zoology, XIII, 1885, Lamellibranchiata, p. 121.
Chione lamellaris, Crosse & Fischer, P., Journ. de Conchyl., XL, 1892, p. 76.
Chione Lamarckii, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Chione Lamarckii, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 834.
Chione (*Antigona*) *lamellaris*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 149.
Antigona lamellaris, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 247.
Venus lamellaris, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51.

The shell is thick, solid and moderately large, distinctly longer than high, with a broadly rounded front margin and a somewhat narrow and truncated hind margin. The upper end of the front margin forms a prominent and well marked shoulder in front of the lunule. The sculpture is very strong, consisting of numerous erect, crest-like concentric lamellae which present a characteristic frilled appearance on account of their being slightly flexuous and traversed by erect, parallel ridges on their lower surfaces. The deep interstices between these lamellae are traversed by broad, low, radial ridges, each of which is rendered double by a medial groove. The hinge margin is thick and the hinge teeth are sharp and rather thin in proportion to the size and thickness of the shell. The tooth in front of the cardinals in the left valve and the hollow in the right are well developed and distinctly seen, though rather small. The lunule is well developed and deeply depressed and heart-shaped. The area behind the umbo is much elongated. The pallial sinus is rather small and bears an angular apex. The inner surface is smooth, glossy and finely crenated at the margin. The shell is whitish, marked with pale brown radially arranged blotches on the outer surface. The inner surface is tinged with a bright orange which deepens towards the umbo. Pamban.

Genus **Chlone** Megerle von Muhlfeld, 1811.

The shell is ovate, or somewhat triangular, not appreciably longer than high, with strong, raised concentric lamellae and with or without radial ribs in addition. The tooth in front of the cardinals in the left valve and the hollow in the right are absent. The pallial sinus is small and angular.

Thiele includes this as a sub-genus under *Venus*, but as in the case of *Antigona*, I have followed Prashad in treating *Chione* as a separate genus as its characters are well defined and distinct.

This genus is represented at Pamban by three species which may be distinguished as follows :—

1. Shell with sculpture consisting of both radial ribs and fine, close-set concentric ridges .. .. *C. scabra.*
—Shell with sculpture consisting of concentric lamellae only, rather widely set and raised much above the general surface level of the shell .. 2
2. Shell thick, somewhat inflated, concentric lamellae thick, strong and very high, sloping towards the umbo ; interspaces between the lamellae in the form of deep, channel-like grooves .. .. *C. tiara.*
—Shell thinner and more flattened, concentric lamellae thinner, weaker, more widely spaced and less strongly raised, sloping away from the umbo, and the interstices between the lamellae in the form of broad flattened spaces .. .. *C. calophylla.*

Chione scabra (Hanley).

Plate XIX, figs. 1*a* and 1*b*.

Venus scabra, Hanley, Proc. Zool. Soc. London, 1844, p. 161.
Venus scabra, Sowerby, Thes. Conchyl., II, 1853, p. 718, pl. clvii, figs. 101 and 102.
Venus scabra, Hanley, Cat. Recent Bivalve Shells, 1856, Appendix, p. 361, pl. xvi, fig. 24.
Venus scabra, Reeve, Conch. Icon., XIV, 1863, *Venus*, pl. xxi, figs. 97 *a* and *b*.
Venus (*Chione*) *scabra*, Smith, "Challenger," Zoology, XIII, 1885, Lamellibranchiata, p. 124.
Chione (*Omphaloclathrum*) *scabra*, Melvill & Standen, Journ. of Conchology, IX, 1898, p. 83.
Chione micra, Pilsbry, Proc. Acad. Nat. Sci. Philadelphia, LVI, 1905, p. 552, pl. xli, figs. 4 and 5.
Chione scabra, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 835.
Venus (*Chione*) *scabra*, Melvill, Trans. Linn. Soc. London, (Zool.), XIII, 1909, p. 133.
Chione (*Timoclea*) *scabra*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 148.

The shell is small, moderately thin, ovate, slightly longer than high, and with an evenly rounded margin all round. The surface is traversed by fine, close-set radial ribs and still finer concentric ridges which cross each other resulting in a closely recticulated sculpture throughout. The hinge teeth are moderately thick. The pallial sinus is small and somewhat bluntly angular. The lunule is large but not depressed. The hinge margin is small and bears three stout cardinal teeth, the tooth in front of the cardinals in the left valve and the corresponding hollow in the right being absent, as in the case of the next two species also. The inner surface is practically smooth, but faint indications of the external radial ridges are represented towards the margin as shallow grooves. The shell is pale brown outside and light purplish brown within. Krusadai Island.

Chione tiara (Dillwyn).

Plate XIX, figs. 2*a* and 2*b*.

Venus tiara, Dillwyn, Descr. Cat., I, 1817, p. 162.
Venus thiara, Catlow & Reeve, Conch. Nomencl., 1845, p. 36.
Venus thiara and *V. alta*, Sowerby, Thes. Conchyl., II, 1853, p. 723, pl. clviii, figs. 125 to 130; p. 724, pl. clviii, figs. 131 to 133.
Venus thiara and *V. alta*, Reeve, Conch. Icon., XIV, 1863, *Venus*, pl. xiii, figs. 109*a*, *b*; 110 and 115.
Chione (Circomphalus) tiara, Adams, A., Ann. & Mag. Nat. Hist., (4), III, 1869, p. 230.
Chione (Circomphalus) foliacea, Dunker, Index Moll. Mar. Japonicum, 1882, p. 198.
Venus tiara, Brazier, Proc. Linn. Soc. N.S. Wales, IX, 1884, p. 799.
Anaitis foliacea, Melvill & Sykes, Proc. Malacol. Soc. London, V, 1898, p. 47.
Anaitis thiara, Melvill & Standen, Journ. Linn. Soc. London (Zool.), XXVIII, 1899, p. 196.
Anaitis foliacea, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Anaitis foliacea and *A. tiara*, Melvill & Standen, Proc. Zool. Soc. London, 1906, pp. 833 and 834.
Antigona tiara, Iredale, Proc. Zool. Soc. London, 1914, p. 666.
Chione (Clausinella) tiara, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 259.
Venus tiara, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51.

The shell is slightly larger, thicker and more solid than in the preceding species. It is about as high as long, with the umbo bent somewhat strongly forwards and placed much nearer the anterior margin than the posterior. The sculpture consists of very strong, thick, raised and rather widely spaced, concentric lamellae which are inclined towards the umbo in adult specimens, but erect in young shells. These concentric lamellae are slightly indented and angled near the posterior margin and turned sharply upwards at the extreme posterior portion of the shell. Anteriorly all the termini of these lamellae converge towards the lunule. The interstices between these lamellae are deeply excavated, but are, however, smooth without any trace of radial ridges. The lunule is clearly defined and slightly depressed. The hinge teeth and pallial sinus are as in the preceding species. The margin of the inner surface is minutely denticulated. The shell is whitish or horny brown with faint radial rows of yellowish brown spots. Pamban.

Chione calophylla (Philippi).

Plate XIX, figs. 3*a* and 3*b*.

Venus calophylla, Philippi, Archiv. Naturgesch, I, 1836, p. 229, pl. viii, fig. 2.
Venus calophylla (sic) and *V. Cumingii*, Sowerby, Thes. Conchyl., II, 1853, p. 724, pl. clx, fig. 176; p. 725, pl. xlvii, fig. 122.
Venus calophylla, Hanley, Cat. Recent Bivalve Shells, Appendix, 1856, p. 361, pl. xvi, fig. 36.
Venus calophylla, Reeve, Conch. Icon., XIV, 1863, *Venus*, pl. xxiii, fig. 114.
Chione (Circomphalus) calophylla, Angas, Proc. Zool. Soc. London, 1867, p. 921.
Chione (Circomphalus) calophylla, Dunker, Index Moll. Mar. Japonicum, 1882, p. 198.
Venus (Chione) calophylla, Brazier, Proc. Linn. Soc. N. S. Wales, IX, 1884, p. 992.
Venus (Chione) calophylla, Smith, "Challenger," Zoology, XIII, 1885, Lamellibranchiata, p. 122.
Anaitis calophylla, Melvill & Sykes, Proc. Malacol. Soc. London, V, 1898, p. 47.
Anaitis calophylla, Melvill & Standen, Journ. Linn. Soc. London (Zoology), XXVII, 1899, p. 196.
Chione calophylla, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 833.

Chione (Circomphalus) calophylla, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 150.
Chione (Clausinella) calophylla, Prashad, Siboga-Expeditie, Monogr. CXVIII, 1932, p. 258.
Venus calophylla, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 51, fig. 20.

This species is widely distributed in the Indo-Pacific Region, and both dead shells and living specimens of it have been collected from the Pamban area. The shell is thinner an more strongly flattened than in the preceding species, with a more or less irregularly rounded outline, the hind margin being almost always rather abruptly truncated. The umbo is small, inconspicuous and placed more or less on the median dorso-ventral axis. The sculpture is very characteristic, consisting solely of thin, widely spaced concentric laminae, inclined away from the umbo, their free edges being somewhat irregular. These laminae are generally about eight or nine in number. The interstices between these laminae are smooth, wide and flattened. The pallial line is scarcely sinuate. The lunule is small, narrow and depressed. The inner surface is smooth and glossy, but very finely crenated at the margin. The shell is whitish, both within and without. Pamban.

Genus **Periglypta** Jukes-Browne, 1914.

The shell is thick, solid and strongly inflated, with radial ribs and concentric ridges forming a closely reticulated sculpture. The ligamentary area is somewhat asymmetrical, and the ligament deeply sunk. The anterior lateral tooth is small and rudimentary.

This genus has been included as a sub-genus under *Venus* by Thiele, but as the characters are sufficiently distinct, I have followed the previous list of Krusadai Lamellibranchs (***Bull. Mad. Govt. Mus. Nat. Hist.***, I, No. 1, 1927, p. 107) in treating this under a separate generic head.

Periglypta is represented in the Pamban area by a single species, *P. fischeri* of which only a single partially worn out left valve washed up on the beach, has been collected and the following description has therefore had to be necessarily based on the single available specimen.

Periglypta fischeri (Récluz).

Plate XIX, figs. 4*a* to *c*.

Venus fischeri, Récluz, Journ. de Conchyl., III, 1852, p. 411, pl. xii, fig. 9.
Venus fischeri, Kuster, Conch. Cab., XI, pt. I, 1872, pl. 40, figs. 1 and 2.
Periglypta fischeri, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 107.

The shell is fairly large, thick, inflated and closely resembles that of *V. reticulata* in its sculpture and general appearance, but may at once be distinguished from the latter by the pallial sinus being markedly truncated and even a little invaginated at its apex. The shell is transversely ovate, convex, rounded and narrowed anteriorly, but broad and somewhat truncated posteriorly. The sculpture is reticulated, consisting of fine, longitudinal

ribs decussated by sharp transverse lamellae which are slightly more widely spaced than the longitudinal ridges. The lunule is depressed and elongately heart-shaped. The hinge bears three stout, widely diverging cardinal teeth. The shell is of a yellowish white colour, ornamented with lines or confluent patches of orange-brown which may either be angular or flexuous. The colour in the present specimen, however, has badly faded to an almost uniform, dull chalky white. Krusadai Island.

Genus **Venerupis** Lamarck, 1818.

The shell is oblong, rectangular or triangularly ovate, with a more or less well defined sculpture consisting of widely spaced, crested, concentric laminae. The umbo is placed close to the front end. The hinge margin is moderately narrow, always with three teeth.

This genus is represented at Krusadai by a single species, *Venerupis macrophylla*, which is also the only species of this genus recorded from the Madras area.

Venerupis macrophylla Deshayes.

Plate XIX, figs. *5a* and *5b*.

Venerupis macrophylla, Deshayes, Proc. Zool. Soc. London, 1853, pl. xviii, fig. 8.
Venerupis macrophylla, Sowerby, Thes. Conchyl., II, 1854, p. 763, pl. clxv, fig. 20.
Rupellaria macrophylla, Adams, A., Ann. & Mag. Nat. Hist., (4), III, 1869, p. 236.
Venerupis macrophylla, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Venerupis*, pl. iv, fig. 23.
Venerupis macrophylla, Dunker, Index Moll. Mar. Japonicum, 1882, p. 209.
Venerupis macrophylla, Cooke, Ann. & Mag. Nat. Hist., (5), XVIII, 1886, p. 103.
Venerupis macrophylla, Smith, Proc. Zool. Soc. London, 1891, p. 425.
Venerupis macrophylla, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Venerupis macrophylla, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 836.
Venerupis Irus, Lynge (ex parte, non Linné), Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 156.
Venerupis macrophylla, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 263.
Venerupis macrophylla, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 52.

This species is widely distributed in the Indo-Pacific Region and is equally well represented at Madras. Both dead shells and living specimens have been collected at Pamban, the latter being generally found wedged in the crevices of coral rock and stones on the reefs. The shell is moderately small and varies in the shape of its outline according to the nature of the available space in the crevice or hole in which the animal lives. It is usually more or less rectangular, much longer than high, broader posteriorly and with a straight lower margin, a slightly arched upper margin and an angular front margin, the umbo being placed very close to the front margin. Occasionally, the umbo is more medially placed and the dorsal margin slopes down on either side of the umbo when the shell assumes a more or less triangular shape. The sculpture is strongly developed and consists of thin, crested concentric lamellae, more strongly raised near the posterior margin and separated by wide interspaces which are traversed by fine, close-set, radiating grooves. The crests

form a sharp angle behind, but are curved anteriorly, being parallel to the outline of the shell throughout. The hinge area is moderately small, with three cardinal teeth which are small in proportion to the size of the shell. The tooth and hollow in front of the cardinals are reduced or absent. The pallial line is deeply sinuate. The inner surface is smooth and its margin is not toothed. The shell is whitish both within and without, but small, pale brown patches may be detected on the inner surface, posteriorly. Pamban.

Genus **Catelysia** E. Romer, 1857.

The shell is more or less elongately ovate, with the umbones approximated and inclined forwards. The surface is either smooth or finely concentrically striated. The lunule and the area are clearly defined. The hinge margin bears three thick, diverging teeth. The margin of the inner surface is smooth.

This genus is represented at Pamban by a single species, *Catelysia opima*, which has also been recorded from the Madras area. It is a species of backwater clam, living shells of which are fairly abundant on the mud flats at Kundugal Point. It is one of the commonest bivalves which has been collected alive at Pamban.

Catelysia opima (Gmelin).

Plate XIX, figs. 6*a* to *c*.

Venus opima, Gmelin, Syst. Nat., Ed. XII, 1758, p. 3279, No. 44.
Venus pinguis, Chemnitz, Conch. Cab., VI, 1782, p. 355, pl. xxxiv, figs. 355–357.
Venus opima, Catlow & Reeve, Conch. Nomencl., 1845, p. 34.
Tapes pinguis, Reeve, Conch. Icon., XIV, 1864, *Tapes*, pl. vii, figs. 33*a* and *b*.
Tapes ceylonensis, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 192, fig. 54.
Catelysia opima, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 52.

The shell is thick, solid and inflated with a smooth and more or less glossy surface, somewhat resembling that of *Meretrix casta* in general appearance, but may be readily distinguished from the latter by its richer and deeper colouration, the pallial line being deeply sinuate and the anterior tooth of the left valve and the corresponding cavity in the right being absent. The shell is slightly longer than high, with an evenly rounded margin. The hinge bears three strong cardinal teeth, the tooth in front of the cardinals in the left valve and the hollow in the right being absent. The lunule is distinct, flattened and rather broad. The area behind the umbones is also well defined, flattened and greatly elongated, reaching almost up to the hind margin of the shell. The muscular impressions are very well marked and even slightly depressed, that of the anterior adductor being more strongly so. The pallial line is deeply sinuate, the apex of the sinus being bluntly angular. The inner surface is smooth, white and polished, and devoid of any trace of denticulation. The outer surface is also highly polished and is pale yellowish brown or straw-coloured, variously clouded, mottled and rayed with purplish grey markings. The pattern most frequently

observed is a number of concentric, undulating lines, running closely parallel, with three or four broad, radially widening, brownish or purplish grey bands diverging downwards from the umbo. The umbo is more pronounced in young specimens. Kundugal Point and Pamban.

Genus **Paphia** (Bolten) Röding, 1798.

The shell is often more or less elongate, smooth or concentrically sculptured with a narrow and elongated lunule. The hinge area is short, with narrowly diverging teeth. The pallial sinus is moderately deep. Both the front and hind margins of the shell are about equally narrowed and rounded.

The three species of *Paphia* recorded from the Pamban area may be distinguished as follows :—

1. Surface of shell smooth and polished .. .. *P. textile.*
— Surface of shell more or less strongly concentrically grooved 2
2. Concentric grooves only moderately strong, obsolete posteriorly. Shell nearly twice as long as high .. .. *P. ala-papilionis.*
— Concentric grooves much stronger and developed throughout the surface. Shell only about one and one-third times as long as high .. .. .. *P. malabarica.*

Paphia textile (Gmelin).

Plate XX, figs. 1*a* and 1*b*.

Venus Textile, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3280.
Venus textile, Lamarck, Anim. sans vert., V, 1818, p. 596.
Pullastra vulgaris, Catlow & Reeve, Conch. Nomencl., 1845, p. 41.
Tapes textile, Sowerby, Thes. Conchyl., II, 1852, p. 681, pl. cxlvi, figs. 26 to 28.
Tapes textrix, Mitchell, Cat. Mus. Madras, 1867, p. 66.
Tapes (Paratapes) textrix, Smith, "Challenger", Zoology, XIII., 1885, Lamellibranchiata, p. 114.
Tapes textrix, Cooke, Ann. & Mag. Nat. Hist., (5), XVIII, 1886, p. 103.
Tapes (Textrix) textrix, Melvill & Standen, Journ. Linn. Soc. London (Zoology), XXVII, 1899, p. 196.
Tapes textrix, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Tapes textrix, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1902, p. 293.
Tapes textrix, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 191.
Paphia (Paratapes) textile, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 239.
Paphia textile, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 52.

The shell is greatly elongate, being nearly twice as long as high. The front margin is rounded and slightly inclined upwards. The hind margin is also rounded, but somewhat narrower than the front margin. The shell is quite smooth and highly polished on the

outer surface. The interior is also perfectly smooth but not glossy. The impressions of the muscles and the mantle edge are well marked and somewhat glossy. The pallial sinus is U-shaped and rather small in proportion to the size of the shell. The hinge bears three narrowly diverging cardinal teeth. The lunule is greatly elongated and extends nearly up to the front end. The outer surface is pale yellowish white, marked throughout with pale purplish grey inverted V-shaped markings, adjacent ones of which sometimes coalesce forming rhombus-shaped islets of the ground colour. Pamban.

Paphia ala-papiliones Röding.

Plate **XX**, fig. 2.

Paphia Ala-papiliones, Röding, Mus. Boltenianum, 1798, p. 175.
Venus papilionacea, Lamarck, Anim. sans vert., V, 1818, p. 596.
Pullastra papilionacea, Catlow & Reeve, Conch. Nomencl., 1845, p. 41.
Tapes papilionacea, Sowerby, Thes. Conchyl., II, 1852, p. 679, pl. cxlv, figs. 1 and 2.
Tapes papilionacea, Chenu, Man. de Conchyl., II, 1862, p. 93, fig. 414.
Tapes rotundata, Reeve (non Linné), Conch. Icon., XIV, 1864, *Tapes*, pl. ii, fig. 7.
Tapes rotundata, Mitchell, Cat. Mus. Madras, 1867, p. 66.
Tapes papilionacea, Crosse & Fischer, Journ. de Conchyl., XL, 1892, p. 76.
Tapes (*Paratapes*) *papilionaceus*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p.140.
Paphia (*Paphia*) *ala-papiliones*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 233.
Paphia ala-papiliones, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 52.

In general appearance and proportions of the height and length, the shell of this species closely resembles that of the preceding species, but the posterior margin is slightly broader in the present one. The ventral margin is almost straight and the front and hind margins are evenly rounded. The surface of the shell is glossy and traversed by regularly spaced concentric grooves, separated by flattened concentric ridges. These concentric grooves lose their distinctness towards the posterior margin, the posterior one-fourth part of the surface being almost smooth and devoid of any definite sculpture. The pallial sinus and the hinge teeth are as in the preceding species. The lunule is relatively broader and more depressed than in *P. textile*. The shell is pale brown, marked with four widely spaced radial bands of brownish patches. Of these four bands, the two anterior ones tend to be very faint and indistinct, the anteriormost being the more so, while the two posterior ones are distinct and sharply marked. Only dead shells have been collected from the Pamban area so far. Pamban.

Paphia malabarica (Chemnitz).

Plate **XX**, figs. 3*a* and 3*b*.

Venus Malabarica, Chemnitz, Conch. Cab., VI, 1782, p. 323, pl. xxxi, figs. 324 and 325.
Venus rhombifera, Hanley, Cat. Recent Bivalve Shells, 1843, p. 120, pl. xiii, fig. 45.
Tapes Malabarica, Sowerby, Thes. Conchyl., II, 1852, p. 682, pl. 145, figs. 6 to 8.

Tapes malabarica, Reeve, Conch. Icon., XIV, 1864, *Tapes*, pl. vi, fig. 27.
Tapes lentiginosa, Reeve, ibid., fig. 25.
Tapes Malabaricus, Fischer, P., Cat. d. Moll. de l'Indo Chine, 1891, p. 234.
Tapes Malabaricus, Smith, Proc. Zool. Soc. London, 1891, p. 424.
Tapes (Paratapes) Malabaricus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 141.
Paphia malabarica, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 192.
Paphia malabarica, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 52.

The shell is proportionately shorter than in either of the two preceding species and is more strongly sculptured than in *Paphia ala-papiliones*. Both the front and hind margins are narrowly rounded and the ventral margin tends to bear a very slight indentation towards the hind end. The surface of the shell is sculptured with strong, close-set, concentric ridges which are raised and rounded, and not flattened as in *P. ala-papiliones*. The separating interstitial grooves are also much deeper than in that species. As the concentric ridges and grooves are strictly parallel to the margin of the shell, they are slightly flexed posteriorly in conformity with the slight indentation of the ventral margin towards the hind end. The hinge bears three, short, thick cardinal teeth, the tooth in front of the cardinals in the left valve and the hollow in the right being rudimentary. The pallial sinus is very deep and U-shaped. The inner surface is quite smooth throughout and its margin not denticulated. The lunule is relatively shorter and broader than in the two preceding species. The shell is of a pale yellowish brown colour, indistinctly rayed with greyish brown bands. Sometimes the surface is more elaborately mottled with brownish angular markings all over. Pamban.

Genus **Tapes** Megerle von Muhlfeld, 1811.

Closely allied to the preceding genus, *Tapes* is readily distinguished from it by the hind margin being broad and more or less obliquely truncated and by the dorsal margin behind the umbo being straighter, less arched and more clearly demarcated from the posterior margin. The shell is strongly concentrically grooved.

This genus is represented at Pamban by two species, *Tapes radiatus* and *T. phillippinarum*. The latter is readily distinguished from the former by the presence of fine, but distinct radial grooves throughout the surface in addition to the concentric sculpture and by the radial sculpture often predominating over the concentric, while in the former there is no trace of radial sculpture.

Tapes radiatus (Chemnitz).

Plate XX, figs. 4*a* and 4*b*.

Venus literata, radiata, Chemnitz, Conch. Cab., VII, 1784, p. 45, pl. 42, fig. 439.
Tapes aspersa, Reeve, Conch. Icon., XIV, 1864, *Tapes*, pl. ii, fig. 5.
Tapes radiatus, Morlet, Journ. de Conchyl., XXXVII, 1889, p. 170, No. 70.
Tapes radiatus, Hidalgo, Obras malacologicas, I, tom. 2, 1903, p. 245, No. 346.
Tapes (Parembola) radiatus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 144.
Tapes aspersa, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 191.

This species is represented in the Museum collection by a single shell from Pamban with both the valves intact. The shell is moderately large, somewhat depressed and oblong, with a rather narrow, rounded front margin and a broad and obliquely sloping hind margin. The umbo is placed far forwards, very near the front margin. The sculpture consists of narrow, thread-like, concentric grooves separating flattened ridges, some of the adjacent ones of which tend to cohere with each other as they approach the front margin. The grooves and ridges become finer and less well defined towards the umbo. The pallial sinus is broad, U-shaped, and extends horizontally inwards from behind. The lunule is narrow, flattened and comparatively short in proportion to the size of the shell. The hinge bears three sharp cardinal teeth, the posterior being separated from the middle by a wider angle than that between the middle and the anterior tooth. The inner surface is smooth, white and glossy. The outer surface is pale yellowish brown, marked with two or three widely diverging radial rows of large, irregular, dark brown blotches, small spots and angular arrow-head-like markings of the same colour scattered rather irregularly all over the surface. The shell in the Museum collection was originally labelled *T. aspersa* Reeve, which is a synonym for *T. radiatus* (Chemnitz). Pamban.

Tapes philppinarum (Adams & Reeve).

Plate XX, figs. *5a* and *5b*.

Venus (Pullastra) Philippinarum, Adams & Reeve. Zoology of the Voyage of H.M.S. "Samarang," Mollusca, 1848, p. 79, No. 1, pl. xxii, fig. 10.

Tapes Philippinarum, Indica, denticulata, Sowerby, Thes. Conchyl., II, 1852, p. 694, Nos. 53, 54, 55; pl. 151, figs 139–141; 146–147, and pl. 150, fig. 114.

Tapes Japonica, Deshayes, Proc. Zool. Soc., London, XXI, 1853, p. 10, No. 44 (non *Venus japonica* Gmelin).

Tapes Indica, semidecussata, denticulata, Reeve, Conch. Icon., XIV, 1864, *Tapes*, pl. xi, fig. 56; pl. xii, fig. 68; pl. xiii, fig. 67.

Tapes (Cuneus) Philippinarum, Dunker, Index Moll. Mar. Japonicum., 1882, p. 207.

Tapes Indica, Hidalgo, Obras malacologicas, I, tom. 2, 1903, p. 273, No. 369.

Tapes (Ruditapes) Philippinarum, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 143.

A single shell collected at Pamban is represented in Mr. Crichton's collections. The shell is shorter, relatively thicker and its outline more evenly rounded than in the preceding species. The umbo is comparatively more centrally placed and the dorsal margin behind it is more strongly arched and sloping. The anterior margin is narrow and rounded and the posterior margin, though rather broad and slightly truncated, is not so sharply marked off by an angle from the dorsal margin as in the preceding species. The sculpture consists of rather fine, close-set, flattened radial ridges, crossed by fine concentric striae. The sculpture is thus a closely decussating one, and at the extreme posterior and anterior margins the radial ridges are more strongly cut up, resulting in the formation of rows of small nodules. A few widely spaced growth lines stand out rather prominently among the concentric striae. The hinge teeth are short and thick, and the lunule large, flattened

and elongated. The pallial sinus is broad and slightly inclined upwards. The inner surface is smooth, glossy and pinkish. The outer surface is pale brown, irregularly marked with white spots and blotches. Pamban.

Genus **Irus** Oken, 1815.

The shell is usually moderately small, elongated, often with a more or less irregular outline. The sculpture is variable. The umbo is close to the front end. The lunule is not well defined. The hinge teeth are often irregular and the hinge area very short and narrow. The margin of the inner surface is smooth.

A single species, *Irus exoticus*, has been recorded from Pamban.

Irus exoticus (Lamarck).

Plate XX, fig. 6.

Venerupis exotica, Lamarck, Anim. sans vert., V, 1818, p. 507.
Venerupis exotica, Reeve, Conch. Icon., XIX, *Venerupis*, pl. ii, fig. 11.
Rupellaria exotica, Dunker, Index Moll. Mar. Japonicum, 1882, p. 209.
Irus exoticus, Cotton & Godfrey, Moll. S. Austral., 1938, p. 246, fig. 274.

Two spirit-preserved specimens, an adult and a young one, with both the valves and the soft parts intact, collected from coral rock at Pamban and identified by Mr. R. Winckworth, are represented in the Museum collection. The shell is rather elongated, almost twice as long as high in the adult, and more or less rectangular in outline. The dorsal and ventral margins are more or less parallel, but the shell is slightly narrowed posteriorly and the posterior margin truncated. The umbo is situated close to the front end and the anterior margin slopes steeply down from the umbo, rounding off into the ventral margin below. The lunule and the area behind the umbo are not clearly defined, but their sites are deeply sunk, and the umbonal region of the shell is more or less glossy and inflated. The sculpture is very characteristic and resembles closely that of *Venerupis macrophylla*. The surface of the shell bears a series of widely spaced, strongly raised concentric lamellae which bend sharply almost at a right angle posteriorly in conformity with the course of the outline of the shell. The outermost of these lamellae are stronger and more prominently raised, especially posteriorly. The wide, flattened interstices between these lamellae are finely but distinctly radiately striated, the striae diverging obliquely from the umbo. The pallial line is deeply sinuate, the hinge teeth irregular and the inner surface smooth at the margins. The shell is whitish, marked with a few reddish lines posteriorly, the markings being more clearly seen in the young specimen in the collection. The adult specimen measures 26 mm. long, 13 mm. high and 9 mm. thick while the young one is 11 mm. long, 7 mm. high and 4 mm. thick. The shell closely resembles that of *Venerupis macrophylla*, but may be readily distinguished from it by its being more narrowed posteriorly and the

dorsal margin being more or less straight or even slightly depressed instead of being arched. The animals live in crevices of coral rock and stones on the reefs. Pamban.

Family PETRICOLIDAE.

This family includes moderately small boring bivalves with a reduced foot and a rounded, or more or less elongated, colourless shell. The right valve bears two and the left three, often irregular cardinal teeth and one lateral tooth. The pallial line is deeply sinuate.

A single genus, *Petricola*, is represented at Pamban.

Genus **Petricola** Lamarck, 1801.

The shell is longer than high, often with an irregular outline. The front margin is rounded and the hind margin either broad and truncated or narrow and rounded. The sculpture consists of distinct, sometimes oblique, radial ribs. The pallial sinus is moderately deep. The shells live attached by means of a byssus within holes and crevices of rocks and dead coral.

Two species, *P. divergens* and *P. lithophaga*, have been recorded from Pamban. The former can be readily distinguished from the latter by the posterior margin being broad and rather squarely truncated, and by the sculpture consisting of characteristic, fine, divaricating radial ridges.

Petricola divergens (Gmelin).

Plate **XX**, figs. 7*a* and 7*b*.

Venus divergens, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3269.
Petricola costata, Lamarck, Anim. sans vert., 1801, p. 121.
Petricola lucinalis, Lamarck, Anim. sans vert., V, 1818, p. 504.
Petricola divaricata, Sowerby, Thes. Conchyl., II, 1854, p. 776, pl. clxvi. figs. 24 and 25.
Choristodon divaricatum, Chenu, Man. de Conchyl., II, 1862, p. 100, fig. 453.
Petricola divaricata, Mabille & Le Mesle, Journ. de Conchyl., XIV, 1866, p. 117.
Petricola divaricata, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Petricola*, pl. iii, fig. 22.
Petricola lapicida (nec Gmelin), Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 113.
Choristodon lapicidum (nec Gmelin), Shopland, Proc. Malacol. Soc. London, V, 1902, p. 178.
Choristodon lapicidum (nec Gmelin), Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 837.
Naranio lapicida (nec Gmelin), Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 157.
Petricola (*Naranio*) *lapicida* (nec Gmelin), Lamy, Journ. de Conchyl., LXVII, 1922, p. 337.
Petricola (*Choristodon*) *divergens*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 264.

This species is represented in the Museum collection by a single shell from Pamban, with both the valves intact. The shell is oblong, almost rectangular in outline, with the umbo placed far forward, almost in a line with the front margin. The ventral and hind margins are more or less straight, the former with a very slight indentation in the middle. The shape of the shell is rather variable, being dependent to a certain extent on the available

space in the crevices of dead coral rock in which these animals generally live. The surface of the shell is traversed by fine, radial diverging striae which collectively give a zig-zag appearance to the sculptural pattern. A few widely-spaced, concentric growth lines are conspicuous. The hinge area is curved and the hinge teeth occupy the antero-dorsal corner of the shell valves. The lunule is obsolete, the area in front of the umbo being only slightly depressed. The pallial sinus is fairly deep, its apex reaching beyond the level of the middle of the valve. The shell is dull whitish, within and without. Pamban.

Petricola lithophaga (Retzius).

Plate XX, figs. 8*a* and 8*b*.

Venus lithophaga, Retzius, Mem. Acad. R.Sc. Turin, III, Mem. des Corresp., 1786, pp. 11 and 14, figs. 1 and 2.

Venus lithophaga, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3295.

Petricola semilamellata, striata, costellata, roccellaria, ruperella, Lamarck, Anim. sans vert., V, 1818, pp. 503, 504 and 505.

Petricola semilamellata, striata, costellata, roccellaria, ruperella, Hanley, Cat. Recent Bivalve Shells, 1843, p. 52, pl. 11, figs. 41 to 45.

Petricola lithophaga, Gray, Proc. Zool. Soc. London, 1847, p. 184.

Petricola lithophaga, Gray, Ann. & Mag. Nat. Hist., (2), XI, 1853, p. 38.

Petricola lithophaga, Sowerby, Thes. Conchyl., II, 1854, p. 774, pl. clxvi, figs. 18 and 19.

Petricola lithophaga and *striata*, Chenu, Man. de Conchyl., II, 1862, p. 100, figs. 448 to 450.

Petricola lithophaga and *semilamellata*, Sowerby in Reeve, Conch. Icon., XIX, 1874, *Petricola*, pl. ii, fig. 11 *a* and *b*; pl. iii, fig. 18.

Petricola lithophaga. Lamy, Journ. de Conchyl., LXVII, 1922, pp. 323–328.

This species is represented in Mr. Crichton's collections by two shells, one from Pamban and the other from Tuticorin. The Pamban shell is the larger of the two and is reported to have been found deeply embedded in coral, but dead when collected. Both the valves are intact, but bear coarse encrustations which obscure the sculpture to a certain extent. The shell is only slightly longer than high and somewhat triangular in outline. The umbo is placed more centrally than in *P. divergens*, but it is still anterior to the middle line, the shell being inequilateral. The anterior margin is broad and rounded, but posteriorly the shell is somewhat attenuated and narrowly rounded. The sculpture consists of fine, but strong radial ridges which are minutely transversely striated and tend to be slightly flexuous as they approach the ventral margin. The posterior ridges are stronger and separated by wider interstitial grooves than the rest. A few widely spaced concentric growth lines are distinctly visible. The hinge and the pallial sinus are as in the preceding species. The shell is white, tinged with dull grey in the middle. Pamban.

SERIES MACTRACEA.

Family MESODESMATIDAE.

The shell is regular, inequilateral and usually elongately triangular, the anterior side being longer than the posterior. The surface is either smooth or finely concentrically

ridged, and almost always covered with a distinct, yellowish brown periostracum. The pallial line is only slightly sinuate. A single genus, *Mesodesma*, is represented at Pamban.

Genus **Mesodesma** Deshayes, 1830.

The shell is generally thick and the two valves are compactly pressed together. It is triangular and slightly inequilateral, the anterior side being longer than the posterior. The hinge is thick, with stout cardinal teeth and a more or less elongated lateral tooth. The pallial sinus is small.

Two species of *Mesodesma* have been recorded from Pamban. They may be recognized as follows :—

Shell thick, solid, with more or less flattened and compressed valves. Inner surface highly glossy. Pallial sinus small and angular. Surface of shell strongly and regularly concentrically striated ..	*M. glabratum.*
Shell thinner, with more strongly inflated valves. Inner surface not glossy or only very slightly so. Pallial sinus shallow and rounded. Surface of shell almost smooth, or only very feebly striated. Rarer	*M. trigona.*

Of these two species, *M. glabratum* is by far the commoner, empty shell valves of this species being fairly abundant on the sandy shores in the Pamban area, especially on Shingle Island.

Mesodesma glabratum (Lamarck).

Plate XX, figs. 9*a* and 9*b*.

Crassatella glabrata, Lamarck, Annales du Mus. d'Hist. Nat., VI, 1805, p. 408.

Crassatella glabrata, Lamarck, Anim. sans vert., V, 1818, p. 482, No. 5, Ed. 2, VI, p. 111, No. 5.

Mesodesma glabratum, Deshayes, Anim. sans vert., Ed. 2, VI, 1835, p. 133, No. 2.

Mesodesma glabratum, Catlow & Reeve, Conch Nomencl., 1845, p. 16.

Paphia glabrata, Adams, H. &. A., Genera of Recent Mollusca, III, 1858, pl. 106, fig. 1.

Mesodesma glabrata and *mitis*, Reeve, Conch. Icon., VIII, 1855, *Mesodesma*, pl. iii, fig. 20 and pl. iv., fig. 29.

Mesodesma (*Paphia*) *glabratum*, E. v. Martens, Journ. Linn. Soc. London (Zoology), XXI, 1887, p. 215, No. 375.

Paphia glabrata, Chenu, Man. de Conchyl., II, 1862, p. 78, fig. 337.

Paphia glabrata, Smith, Fauna and Geography of the Maldive and Laccadive Archipelagoes, II, 1903, p. 626.

Mesodesma glabratum, Dautzenberg & Fischer, Journ. de Conchyl., LIII, 1905, p. 233.

Mesodesma (*Atactodea*) *glabrata*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 122.

Mesodesma glabratum, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 182, fig. 49.

Mesodesma (*Atactodea*) *glabrata*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p- 206.

The shell is thick, solid, compressed and generally somewhat triangular in outline, with a narrow, more or less pointed hind end and a comparatively broad and rounded front margin. The shell is only slightly inequilateral, the anterior side being just a little longer than the posterior. The surface of the shell is closely and strongly concentrically striated, these striae being more pronounced towards the ventral and posterior margins. When the two valves are placed together in the closed position, the portion behind the umbo forms a well defined, flattened area, traversed longitudinally by the strong terminal parts of the concentric striae. The umbones are small, and there is no lunule. The hinge bears two thick cardinal teeth in each valve with a deep triangular pit in between them, in which the ligament is embedded. A more or less elongated anterior lateral tooth is also present. The pallial sinus is small and angular. The inner surface is smooth, glossy and white. The outer surface is whitish towards the umbo and yellowish brown towards the margins, the latter colour being mainly due to the presence of remnants of the horny, brown periostracum which covers the shell in the fresh condition. Lynge remarks that this species has often been confused with *M. striata*, and that the shell assumes some variation in the shape of its outline, ranging from a high triangle to an oblong-ovate form. Living specimens of this species have been collected from Kundugal Point. Pamban, Kundugal Point, Krusadai and Shingle Islands.

Mesodesma trigona Deshayes.

Plate XXI, figs. 1*a* and 1*b*.

Mesodesma trigona, Deshayes, Encyclopédie Méthodique, Vers. II, 1830, p. 444.
Mesodesma trigonum, Catlow & Reeve, Conch. Nomencl., 1845, p. 16.
Mesodesma trigona, Reeve, Conch. Icon., VIII, 1854, *Mesodesma*, pl. iii, fig. 19.
Paphia trigona, Adams, H. & A., Genera of Recent Mollusca, II, 1857, p. 413.
Mesodesma trigonum, Lamy, Journ. de Conchyl., LXII, 1914, p. 48.

The shell is thinner, but considerably more inflated than in the preceding species. It is relatively high, with a rounded posterior margin and a narrow, somewhat blunt, beak-like anterior margin, bearing a slight resemblance to the anterior margin of the shell of *Crassatella rostrata*. The outer surface of the shell is practically smooth, but on close examination it is found to be finely concentrically striated throughout. The areas behind and in front of the umbo are well defined, broad and more or less depressed and the concentric striae are more pronounced in these areas. The hinge teeth are thinner than in the preceding species, and the ligamentary pit in the middle is well developed. The lateral teeth are much elongated. The pallial sinus is very shallow and rounded. The inner surface is smooth, but not polished as in *M. glabratum*. The shell is whitish both on the inner and outer surfaces, but the latter is usually marked with faint greyish blotches. Pamban.

Family MACTRIDAE.

The shell is more or less triangularly ovate in outline and almost equilateral. The ligament is partly internal and provided with a large internal nodule which is sunk into

a correspondingly large and prominent hinge pit. The left valve bears a single cardinal tooth and usually also an anterior and a posterior lateral tooth, which are thin and elongated and fit into corresponding grooves in the right valve which bears two cardinal teeth. The pallial line is distinctly sinuate.

This family, including the so called false clams, is represented at Pamban by two genera, *Mactra* and *Standella*. *Standella* is represented at Pamban by a single species which has been included by Lynge and other authors under *Eastonia* which Thiele treats as a sub-genus under *Standella.*

In *Eastonia*, which is represented at Pamban by only a single species, the shell is rather ovate and transversely elongated and bears a distinct radial sculpture in the form of fine, close-set radial ridges, while in *Mactra*, which is represented at Pamban by four species, the shell is more or less triangularly rounded in outline, being hardly longer than high, and the surface is almost always smooth and highly polished or at most minutely and indistinctly concentrically striated.

Genus Mactra Linné, 1767.

The shell is triangular, or ovate, sometimes slightly gaping. The ligament is well developed and its nodule is separated from it by a transverse calcareous ridge. The lateral teeth are thin and transversely elongate. The pallial sinus is distinct and fairly large and rounded.

The four species of *Mactra* recorded from the Pamban area may be distinguished as follows :—

1. Shell large, strongly inflated, whitish, smooth, or indistinctly concentrically striated, often tinged with pinkish violet towards the umbo	*M. turgida.*
— Shell smaller, and at most moderately inflated, not whitish, generally more or less brightly coloured	2
2. Shell rather thick, more or less distinctly rayed with irregularly spaced white radial bands, the ground colour being pale brown, or yellowish brown. Umbo only moderately elevated ..	*M. mera.*
— Shell thinner, colour and colour pattern not as above, generally purplish or violet. Umbo more strongly elevated	3

3. Shell moderately large, transversely ovate, being definitely longer than high. Shell comparatively less inflated in proportion to the size. Violet throughout. Rarer .. .. *M. violacea.*

— Shell thinner and smaller, triangularly ovate and proportion of length to height much less, the shell being almost as high as long or only very slightly longer than high. Shell comparatively more inflated in proportion to the size, pale bluish violet on the outer surface and deep violet inside .. *M. cuneata.*

Mactra cuneata Chemnitz.

Plate XXI, figs. 2*a* and 2*b*.

Mactra cuneata, Chemnitz, Conch. Cab., VI, 1782, p. 221, pl. xxii, fig. 215.

Mactra cuneata, Hanley, Cat. Recent Bivalve Shells, 1843, p. 34.

Mactra corbiculoides, Deshayes, Proc. Zool. Soc. London, 1854, p. 62.

Mactra lurida, *corbiculoides* and *cuneata*, Reeve Conch. Icon., VIII, 1854, pl. xviii, figs. 96 and 98 and pl. xix, fig. 109.

Trigonella corbiculoides, *cuneata* and *lurida*, Adams, H. & A., Genera of Recent Mollusca, II, 1856, pp. 375 and 376.

Trigonella lurida, Dunker, Index Moll. Mar. Japonicum, 1882, p. 183.

Mactra (*Trigonella*) *cuneata*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 124, pl. iv, figs. 17 to 19.

Mactra cuneata, Lamy, Journ. de Conchyl., LXIII, 1917, p. 229.

Mactra corbiculoides, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 183, fig. 50 and p. 192.

This is the commonest species of *Mactra* collected in the Pamban area. Large numbers of shells, both empty valves and living specimens have been collected on the mud flats at Kundugal Point where they are found along with specimens of other clams such as *Catelysia opima*, *Meretrix casta* and species of *Gafrarium*. The shell is somewhat small and triangularly ovate in outline, the anterior margin being slightly broader than the posterior. The shell is slightly inequilateral, the posterior side being a little longer than the anterior. The hinge bears on the left valve a bent cardinal tooth with the pit for the ligamentary nodule just behind it, and two thin transversely elongated lateral teeth, an anterior and a posterior, and on the right valve two cardinal teeth, with the ligamentary pit lying between them and two lateral grooves for the reception of the lateral teeth of the left valve. The pallial sinus is very shallow and rounded. The inner surface is smooth and deep purplish violet, the colour being deeper towards the periphery than in the middle. The outer surface is pale greyish violet, often more or less irregularly banded with concentric bluish lines and tinged with deep violet blue towards the umbo. Some shells of this species are entirely white and these have been referred to the variety *albida*. Both dead shells and living specimens have been collected. In Mr. Crichton's collections there are a few shells from

Pamban, labelled *Mactra corbiculoides*, which is but a synonym for *M. cuneata*. Kundugal Point and Pamban.

Mactra turgida Gmelin.

Plate XXI, figs. 3*a* and 3*b*.

Mactra turgida, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3260.
Mactra turgida, Lamarck, Anim. sans vert., V, 1818, p. 475.
Mactra turgida, Sowerby, Genera of Shells, 1824, *Mactra*, pl. i, fig. 2.
Mactra tumida, Gray, Mag. Nat. Hist., n.s., I, 1837, p. 371.
Mactra cordiformis and *tumida*, Reeve, Conch. Icon., VIII, 1854, *Mactra*, pl. ii, fig. 6 ; pl. vi, fig. 21.
Mactra turgida, Chenu, Man. de Conchyl., II, 1862, p. 54, figs. 223 and 224.
Mactra turgida, Proc. Malacol. Soc. London, XI, 1914, p. 149.
Mactra (*Codomactra*) *turgida*, Lamy, Journ. de Conchyl., LXIII, 1917, p. 240.
Mactra turgida, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 54.

Empty shell valves of this species are frequently found washed up on the sandy shores, especially over the mud flats at Kundugal Point. The shell is large, strongly inflated, rather thin for its size, whitish and is easily recognized by its smooth, glossy surface and prominent, elevated umbo which is often tinted pinkish violet. The shell is triangularly ovate, almost equilateral, with the front and hind margins about equally broad and rounded. The surface of the shell is nearly entirely smooth and polished, but fine, irregularly spaced concentric striae are often present, which become stronger and more uniformly disposed on the lunule and the area behind the umbo. The umbo is conspicuously elevated, and the umbonal area and the part of the surface immediately below it are smooth and highly polished. The hinge teeth are disposed as in the preceding species. The pit for the ligamentary nodule is relatively large in this species and the lateral teeth are longer, the anterior being more so. The pallial sinus is short, broad, obliquely inclined upwards and somewhat squarish at its apex. The inner surface is smooth and white, and the outer surface is generally white over the greater part, but occasionally yellowish white or pale greyish, and almost always coloured deep pinkish violet towards the umbo. Pamban and Kundugal Point.

Mactra mera Reeve.

Plate XXI, figs. 4*a* and 4*b*.

Mactra antiquata (non Spengler) and *mera*, Reeve, Conch. Icon., VIII, 1854, *Mactra*, pl. vi, fig. 22 ; pl. xvi, fig. 82.
Mactra mera, Deshayes, Proc. Zool. Soc. London (vol. for 1853), 1854, p. 16.
Trigonella mera, Adams, H. & A., Genera of Recent Mollusca, II, 1856, p. 376.
Trigonella mera, Conard, Amer. Journ. Conch., III, 1868, p. 376.
Mactra antiquata (non Spengler), Weinkauff, in Martini-Chemnitz, Conch. Cab. (N.F.), XI (2), 1881, *Mactra*, p. 41, pl. xiii, figs. 4 and 5.
Mactra mera, Weinkauff, ibid., 1884, p. 109, pl. xxxvi, fig. 7.
Mactra mera, Smith, Proc. Malacol. Soc. London, XI, 1914, p. 144.
Mactra (*Mactra*) *mera*, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 209.
Mactra mera, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 54.

This species, though well represented at Madras, is less common than the preceding species of *Mactra* in the Pamban area. The shell is moderately thick and inflated but to a less extent than in *Mactra turgida* which attains a much larger size. It is longer in proportion to the height than in either of the two preceding species, and slightly inequilateral, the anterior side being a little shorter than the posterior. The hind margin is slightly narrower and more pointed than the front margin which is more or less broadly rounded. The surface of the shell is smooth and highly polished, but the lunule and the area behind the umbo are more or less distinctly traversed by regular, concentric striae. The umbo is somewhat depressed, not so elevated and beak-like as in *Mactra turgida*. The hinge teeth are as in the preceding species but the pit for the nodule of the ligament is rather small in proportion to the size of the shell, somewhat squarish or triangular, not rounded as in *Mactra turgida*. The pallial sinus is fairly deep, rounded and extends horizontally. The inner surface is smooth, polished and whitish, usually with one or two broad, deep violet radial bands extending from the umbo down to a little below the middle of the shell. The outer surface is yellowish brown, or more or less straw-coloured, rayed with whitish radial bands of varying widths, diverging from the umbo and rather irregularly spaced. The shell resembles somewhat those of *Catelysia opima* and *Meretrix casta* in general external appearance, though it is slightly thinner. Kundugal Point.

Mactra violacea Chemnitz.

Plate XXI, figs. *5a* and *5b*.

Mactra violacea, Chemnitz, Conch. Cab., VI, 1782, pp. 208 and 220, pl. xxii, figs. 213 and 214.
Mactra violacea, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3260.
Mactra violacea, Lamarck, Anim. *sans* vert., V, 1818, p. 475.
Mactra violacea, Hanley, Cat. Recent Bivalve Shells, 1842, p. 30.
Mactra violacea, Reeve, Conch. Icon., VIII, 1854, *Mactra*, pl. xii, fig. 57.
Triganella violacea, Adams, H. & A., Genera of Recent Mollusca, II, 1856, p. 376.
Mactra (Coelomactra) violacea, Dall, Proc. Malacol. Soc. London, I, 1894, p. 211.
Mactra violacea, Dautzenberg & Fischer, Journ. de Conchyl., LIV, 1906, p. 223.
Mactra (Coelomactra) violacea, Lamy, Journ. de Conchyl., LXIII, 1917, p. 238.
Mactra violacea, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 55.

The shell is fairly large, the single shell from the Coromandel coast collected by Mr. Crichton and referred to by Dr. Gravely in his paper on Madras Shells (*loc. cit.*) being the largest of this species in the Museum collection, measuring 70 mm. long and 50 mm. high. Only a few bleached empty valves of this species have been collected from the Pamban area. The shell is only moderately inflated, and distinctly longer in proportion to the height than in *Mactra turgida*. The umbo is prominent, well elevated, and slightly inclined forwards. The shell is slightly inequilateral, the part anterior to the umbo being a little longer than that behind it. Both the anterior and posterior margins are about equally broad and rounded. The surface is finely concentrically striated and growth lines are

conspicuous, particularly towards the ventral margin. The umbonal area is almost perfectly smooth and glossy. The hinge teeth are disposed as in *Mactra turgida*, but the lateral teeth are more elongated. The pit for the ligamentary nodule is triangular. The pallial sinus is broad and moderately deep. The outer surface is violet throughout, the colour deepening towards the umbo. The inner surface is also violet, but the colour is much deeper within the area bounded by the pallial line. This species is considerably rarer at Pamban than any of the three preceding ones of *Mactra*. Kundugal Point and Pamban.

Genus **Standella** Gray, 1853.

The shell is ovate, gaping in front and behind, often with radial sculpture. The umbo is situated in front of the middle, the shell being inequilateral. The ligament nodule is not divided by a calcareous lamella. The anterior lateral tooth is short and close to the cardinal teeth. The lateral teeth are smooth, and rendered double in the right valve. The pallial sinus is deep and rounded in front.

The single species of this genus recorded from the Pamban area, *Standella nicobarica* Gmelin, belongs to the subgenus *Eastonia* Gray, 1853, which is characterised by a slightly thickened, moderately inflated and elongately ovate shell with distinct radial sculpture. The genus *Standella* is also represented in the Madras area by a single species, *S. pellucida*, but *S. nicobarica* is easily distinguished from it by the presence of fine, radial ridges on the surface of the shell.

Standella nicobarica (Gmelin).

Plate XXIII, figs. 1*a* and 1*b*.

Mactra rugosa Indiae orientalis, Chemnitz, Conch. Cab., VI, 1782, p. 238, pl. xxiv, fig. 237.
Mactra nicobarica, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3261.
Mactra aegyptiaca, Chemnitz, Conch. Cab., XI, 1795, p. 218, pl. 200, figs. 1955 and 1956.
Spisula nicobarica, Gray, Mag. Nat. Hist., n.s., I, 1837, p. 373.
Spisula aegyptiaca, Gray, ibid., p. 373.
Lutraria aegyptiaca, Hanley, Cat. Recent Bivalve Shells, 1842, p. 26.
Standella aegyptiaca, Gray, Ann. & Mag. Nat. Hist., 2nd Series, XI, 1853, p. 42.
Mactra aegyptiaca, Reeve, Conch. Icon., VIII, 1854, *Mactra*, pl. xx, fig. 112.
Anatinella nicobarica, Tennant, Natural History of Ceylon, 1861, p. 389.
Standella (Merope) aegyptiaca, Chenu, Man. de Conchyl., II, 1862, p. 60, fig. 246.
Merope aegyptiaca, Angas, Proc. Zool. Soc. London, 1871, p. 100.
Merope aegyptiaca, Dunker, Index Moll. Mar. Japonicum, 1882, p. 184.
Standella (Merope) aegyptiaca, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 828.
Eastonia (Merope) nicobarica, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 129.
Mactra (Standella) aegyptiaca, Smith, Proc. Malacol. Soc. London, XI, 1914, p. 139.
Standella (Eastonia) noicobarica, Lamy, Journ. de Conchyl., LXIII, 1917, p. 389.

Dead shells of this species are found frequently washed up on the beach in fairly large numbers on Krusadai Island. The shell is somewhat thin, pure white, transversely elongated, with a more or less ovate outline, and slightly gaping at both the anterior and posterior margins. The shell is markedly inequilateral, the anterior side being much

shorter than the posterior. The hind margin is more narrowly rounded than the front and is sometimes inclined to be slightly turnedupwards. The sculpture consists of fine, close-set, radial ridges, the interstices between them being represented by narrow, flattened spaces, varying in their widths within a limited range. The ribs sometimes tend to be slightly flexuous as they approach the ventral margin. At the extreme posterior part of the shell, the ribs are much finer, much more closely set and diverge away from the direction of the main ribs, thus forming a more or less distinct group by themselves. A few faint, widely spaced concentric growth lines are also present on the surface. The ligament is not separated from its nodule by any calcareous ridge as in *Mactra*. The cardinal tooth on the left valve is bent at a very narrow angle. The anterior cardinal tooth on the right valve is very small, but the lateral teeth on the left valve are well developed, though the front one is rather small, and there are grooves for their reception on the right valve. The pit for the nodule of the ligament is more or less triangular. The umbo is small and the shell is deepest in the region of the umbo. The pallial sinus is very deep, large and rounded. The inner surface is smooth and glossy and the external ribs are clearly seen through, the shell being slightly translucent. The shell is pure white, both within and without. Krusadai and Shingle Islands.

SERIES TELLINACEA.

Family DONACIDAE.

The shells included in this family are popularly known as 'wedge shells' by reason of their shape and general appearance. The shell is triangular, more or less elongate and compressed, and either smooth or sculptured. The ligament is short, swollen and sunk in a furrow. The shell is inequilateral, the anterior side being the longer. The hinge bears two cardinal teeth, which are usually fused into one triangular tooth on the right valve. The lateral teeth are either well developed or rudimentary. The pallial line is deeply sinuate.

Only a single genus, *Donax*, is represented at Pamban by seven species, of which four have been recorded also from the Madras area.

Genus Donax Linné, 1758.

The shell is triangular, more or less elongate and inequilateral, the posterior side being shorter than the anterior. The surface is either smooth or strongly sculptured. The umbo is moderately small and the nodule of the ligament is external and sunk in a slight depression. The pallial sinus is deep and rounded.

The seven species recorded from Pamban may be distinguished with the aid of the following key :—

1. Shell with a strong, sharply defined keel extending obliquely down from the umbo near the posterior margin 2

— Shell entirely devoid of a keel, or keel, if present, very ill-definied and obtuse, not sharp and distinctly angulated 3

2. Umbo placed just a little behind the middle. Shell large and strongly sculptured with concentric ridges and weaker radial ribs. Keel curved and terminating at the sharply pointed ventro-posterior corner of the margin. Surface behind the keel concavely depressed. Common .. .. .. *D. scortum.*

— Umbo placed far behind the middle. Shell smaller, almost smooth, except in the region of the keel, where it is transversely ridged. Keel straighter and terminating at the somewhat blunt ventro-posterior angle of the shell. Surface behind the keel flattened or even slightly convex. Rarer, *D. spinosus.*

3. Shell entirely devoid of a keel, uniformly and finely concentrically striated throughout. Outline of shell more or less evenly rounded and devoid of sharp angles .. .. *D. faba.*

— An obtuse keel present near the posterior margin of the shell. Surface of shell not uniformly sculptured, usually partly smooth and partly sculptured with radial and concentric ridges, or partly finely striated and partly strongly ridged. Shell more strongly triangular in outline. 4

4. Area behind the obtuse keel finely radially ridged near the keel and strongly concentrically ridged near the hind margin, the intervening median portion of this area being rendered granular by the merging and decussation of these two sets of ridges. Rest of the surface of the shell smooth. Shell generally bluish, rayed with diverging white bands .. .. *D. cuneatus.*

—Sculpture not as above. Shell much smaller, thinner and more delicate. Hind portion of shell either strongly radially or concentrically ridged. Colour not as above, varied 5

5. Shell broadly triangular, somewhat high, very inequilateral, the posterior side being very short, sloping steeply down from the umbo. Sculpture near posterior margin either concentric or reticulate 6

—Shell shorter, much more elongated transversely. Posterior side longer and sloping more gradually down from the umbo. Shell strongly radially ridged near the posterior margin. Rest of the surface finely striated .. .. *D. aperittus.*

6. Portion of the surface behind and immediately in front of the obtuse keel strongly reticulately sculptured with close-set radial and concentric ridges. Rest of the surface very finely concentrically striated. Posterior margin obtusely truncated. Shell pale ash-coloured, usually with one or two darker coloured radial bands .. .. *D. lubrica.*

—Posterior portion of the surface of the shell conspicuously sculptured with somewhat undulating concentric ridges. Rest of the surface very finely radiately grooved. Posterior margin somewht obtusely angulated. Shell generally of a bright fleshy pink colour with one or more darker reddish concentric bands .. .. *D. incarnatus.*

Donax cuneatus Linné.

Plate XXII, figs. 2*a* and 2*b*.

Donax cuneata, Linné, Syst. Nat., Ed. X, 1758, p. 683.
Donax cuneata, Sowerby, Genera of Shells, II, 1830, *Donax*, fig. 2.
Donax Australis, Quoy & Gaimard, Voy. " Astrolabe," III, 1834, p. 493, pl. lxxxi, figs. 20–22.
Donax cuneata, *granosa*, *Australis* and *bicolor*, Deshayes in Lamarck, Anim. sans vert., VI, 1835, pp. 240–243.
Donax cuneata and *Australis*, Hanley, Cat.Recent Bivalve Shells, 1843, pp. 79, 80 ; pl. xiv, fig. 29.
Donax cuneata, Catlow & Reeve, Conch. Nomencl., 1845, p. 27.
Latona cuneata, Gray, Proc. Zool. Soc. London, 1847, p. 187.
Latona cuneata, Chenu, Man. de Conchyl., II, 1862, p. 72, fig. 309.

Donax bicolor, Dunker, Index Moll. Mar. Japonicum, 1882, p. 194.
Donax (Latona) cuneatus, Melvill & Sykes, Proc. Malacol. Soc. London, III, 1898, p. 47.
Donax (Latona) cuneatus, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1903, p. 293.
Donax (Latona) cuneatus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 120.
Donax cuneatus, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 181, fig. 47.
Donax (Latona) cuneata, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 202.
Donax cuneatus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 56.

This is one of the commonest species of *Donax* recorded from the Krusadai Island area, and is equally well represented on the Madras coast. Living specimens may be generally collected in large numbers by digging up with a shovel the wet sand on the shore line left exposed by the receding waves, as these bivalves burrow rapidly with the aid of their powerful muscular foot in such situations. In the Pamban area they are most common on the beach of Krusadai Island, particularly around Sandy Point. Empty valves are also found frequently washed up on the beach in large numbers. The shell is moderately large, thick, rather compressed, inequilateral and elongately triangular, the posterior side being much shorter and inclining more steeply down from the umbo than the anterior side. The anterior margin is broad and rounded, the posterior narrow, angular and truncated. There is an oblique, obtuse, radial keel running down from the umbo very near the posterior margin. It is the area between this keel and the hind margin that is strongly sculptured as described in the diagnostic key given above. This area appears rough and coarsely granulated on casual observation. The rest of the surface is finely radiately striated. The hinge teeth are disposed as stated in the generic description above. The pallial sinus is very broad, deep and obliquely ascending. The inner surface is smooth and its margin untoothed. The colour of the shell is subject to considerable variation. It is generally pale purplish or bluish grey, marked with fine, irregular, reddish brown radial lines, somewhat interrupted and often branching or coalescing. In addition, there are a few broad, white bands radiating from the umbo, Pamban, Krusadai and Shingle Islands.

Donax scortum Linné.

Plate XXII, figs. 3*a* and 3*b*.

Donax scortum, Linné, Syst. Nat., Ed. XII, 1767, p. 1126.
Donax scortum, Sowerby, Genera of Shells, II, 1830, *Donax*, fig. 1.
Donax scortum, Catlow & Reeve, Conch. Nomencl., 1845, p. 28.
Donax scortum, Reeve, Conch. Icon., VIII, 1855, *Donax*, pl. i, fig. 1.
Hecuba scortum, Chenu, Man. de Conchyl., II, 1862, p. 72, figs. 311 to 313.
Donax scortum, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 56.
Donax scortum, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, pp. 181 and 182, fig. 48.

Dead shells of this species are particularly common on the mud flats at Kundugal Point, but are also frequently found washed up on the shores of Krusadai and Shingle Islands. Living specimens have also been occasionally collected from the reefs. This

species is better represented in the Madras area. The shell is readily distinguished from those of the other Pamban species of *Donax* by its large size, by the presence of a sharp, very strong, curved keel extending from the umbo down to the postero-ventral corner of the shell margin, and by the very strongly developed sculpture consisting of sharp, concentric ridges. The ridges tend to be strongly crested towards the anterior and posterior margins and are crossed by finer radial ridges, which, however, are conspicuous only in the anterior and posterior portions of the surface. The hind end of the shell is narrow and pointed, coinciding with the termination of the keel, while the anterior margin is broader and more rounded. The ventral margin of the shell shows a slight, but distinct upward bend as it approaches the hind margin and meets the latter at the sharply angulated point where the strong, curved keel extending from the umbo terminates. The portion of the surface of the shell behind the keel is deeply concavely depressed and is almost smooth, except for the presence of fine, decussating striae. The lunule is clearly defined and greatly elongated. The pallial sinus is broad, deep, rounded and almost horizontal. The outer surface is dirty white, suffused with pale violet especially towards the umbo and the posterior margin where the colour deepens considerably. The inner surface is smooth, glossy and deep violet in colour. Kundugal Point, Krusadai and Shingle Islands.

Donax faba Gmelin.

Plate XXII, figs. *4a* to *c*.

Donax faba and *radiata*, Gmelin, Syst. Nat., Ed. XIII, 1790, pp. 3264 and 3266.
Donax faba, Hanley, Cat. Recent Bivalve Shells, 1843, p. 80.
Donax radians, Catlow & Reeve, Conch. Nomencl., 1845, p. 28.
Donax radians, Reeve, Conch. Icon., VIII, *Donax*, 1854, pl. v, figs. 26 a-c.
Donax (Latona) faba, Adams, H. & A., Genera of Recent Mollusca, II, 1856, p. 405.
Donax (Latona) radians, Chenu, Man. de Conchyl, II, 1862, p. 72, fig. 310.
Donax radians, Sowerby, Thes. Conchyl., III, 1866, p. 312, pl. cclxxxiii, figs. 91 to 95.
Donax faba, Morlet, Journ. de Conchyl., XXXVII, 1889, p. 171.
Donax faba, Smith, Proc. Zool. Soc. London, 1891, p. 435.
Donax faba, Dautzenberg & Fischer, Journ. de Conchyl., LIII, 1905, p. 469.
Donax (Latona) faba, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 121.
Donax (Latona) faba, Melvill, Trans. Linn. Soc. London (Zoology), XIII, 1909, p. 131.
Donax (Latona) faba, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 204.

This species is widely distributed in the Indo-Pacific Region, and the shell is about as variable in its colouration and form as that of *D. cuneatus*. This species is fairly common in the Pamban area and the shells are often found more or less in the same situations as, and even in association with, specimens of *D. cuneatus*. They burrow rapidly in the moist sand on the shore line, and in some places they are so abundant that they may be collected literally in handfuls by digging up the wet sand. Large numbers of living specimens have been collected from the sandy shores at Thangachimatam, a fishing village near Pamban. The shell is moderately small, smaller in average size than that of *D. cuneatus*, and bears a more

or less evenly rounded outline, the sharp angles in the outline characteristic of the two preceding species being altogether absent here. The shell is ovate and transversely elongate, young specimens being proportionately more so. The surface of the shell is finely concentrically striated throughout. The radial keel extending from the umbo near the posterior margin is entirely absent in this species. The shell is inequilateral, the anterior side being much longer. The ventral margin bears a very slight, but distinct indentation towards the posterior end, and this appears to be a very constant character in this species. The lunule is very narrow, elongated and not very well defined. The pallial sinus is broad, moderately deep, slightly inclined upwards and shaped like the tip of the thumb. The inner surface is smooth, glossy and tinged with various shades of purple. The colour and colour pattern of the shell is subject to considerable variation. Most of the Pamban shells in the Museum collection are pale bluish grey or ashy blue, traversed by slate-coloured concentric bands, and variously mottled and rayed with brownish markings. Pamban, Krusadai and Shingle Islands.

Donax lubrica Hanley.

Plate XXII, fig. 5.

Donax lubrica, Hanley, Proc. Zool. Soc. London, 1845, p. 17.
Donax lubrica, Reeve, Conch. Icon., VIII, 1855, *Donax*, pl. vii, fig. 46.

The shell is very inequilateral, the posterior side being much shorter and sloping steeply down from the umbo. It is broadly triangular in shape and proportionately higher than in the preceding species. There is an obtuse keel near the posterior margin as in *D. cuneatus*, and the portion of the surface behind and immediately in front of this keel is strongly reticulately sculptured with close-set radial and concentric ridges. The rest of the surface is very finely concentrically striated, though it appears smooth and glossy on casual observation. The lunule is not well defined, and the external ligament is very short and rounded. The pallial sinus is broad, deep and very large for the size of the shell. The inner surface is smooth, polished, deep violet anteriorly and whitish posteriorly, and rayed with two distinct, well separated, violet radial bands. The margin of the inner surface is finely denticulated. The outer surface is pale ash-coloured, irregularly concentrically banded with bluish grey and brownish towards the umbo. A few shells of this species are represented in Mr. Crichton's collections, but specimens have not been so far collected alive from the Pamban area. Pamban and Krusadai Island.

Donax incarnatus Chemnitz.

Plate XXII, figs. *6a* to *d*.

Donax incarnatus, Chemnitz, Conch. Cab., VI, 1782, p. 265; pl. xxvi, figs. 266 and 267.
Donax incarnata, Catlow & Reeve, Conch. Nomencl., 1845, p. 28

Donax Dysoni, Deshayes, Proc. Zool. Soc. London, XXII, 1854, p. 353, No. 167.
(non *D. Dysoni* Lischke = *D. semigranosus* Dunker).
Donax incarnata, Reeve, Conch. Icon., VIII, 1865, *Donax*, pl. viii, fig. 53.
Donax Dysoni, Reeve, ibid., fig. 54.
Donax incarnatus, Chenu, Man. de Conchyl., II, 1862, p. 72, fig. 307.
Donax incarnatus, Sowerby, Thes. Conchyl., III, 1866, p. 311, No. 43 ; pl. 283, figs. 98 and 99.
Donax incarnatus, Dautzenberg & Fischer, Journ. de Conchyl., LIII, 1905, p. 468, and LIV, 1906, p. 219.
Donax (Serrula) incarnatus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 119 ; pl. iv, figs. 12 and 13.

A few shells of this species are represented in Mr. Crichton's collections presented to the Museum. There is also a small single valve from Pamban in the original collections of the Museum, labelled *D. dysoni*, but as pointed out by Lynge (*loc. cit.*) *D. dysoni* is the same as *D. incarnatus* and appears to be a young form of the latter, as confirmed by Melvill and Abercrombie (The Marine Mollusca of Bombay, *Mem. & Proc. Manch. Lit. & Phil. Soc.*, ser. 4, VII, p. 47). The shell is rather high and sharply triangular in outline, strongly inequilateral, with a short, steeply sloping posterior side and a long, gradually inclining dorsal margin in front of the umbo. Ventro-posteriorly the outline is rather angulated. Anteriorly, the shell is more or less narrowly rounded. The lunule is narrow, greatly elongated and slightly depressed and the external ligamentary area behind the umbo is short and rounded. The area marked by the keel and the portion of the surface behind it are conspicuously sculptured with somewhat undulating, concentric ridges. The rest of the surface is very finely and closely radiately grooved. The surface as a rule presents a smooth and glossy appearance, especially towards the umbones. The pallial sinus is very wide, deep, U-shaped and reaches even a little beyond the middle of the valve. On the inner surface, the muscle impressions and the area outside the pallial line are pale fleshy pink, while the area within it including the area of the pallial sinus is opaque and chalky white. The margin of the inner surface is finely grooved. The outer surface is pale fleshy pink or even whitish, tinged slightly with pink and variously banded with darker reddish or pinkish concentric bands. The umbonal area is usually deeply tinted with pink. The small, single right valve in the collection labelled *D. dysoni* is whitish, with pale purplish rays at the umbo, and is presumably a young shell of *D. incarnatus*. Pamban.

Donax spinosus Gmelin.

Plate XXII, figs. 7*a* and 7*b*.

Donax spinosus, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3265, No. 13.
Donax paxillus, Reeve, Conch. Icon., VIII, 1855, *Donax*, pl. viii, fig. 55.
Donax spinosus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 56.

The shell is relatively more elongate than in *D. lubrica*, but resembles it in the general shape of its outline, and in the margin of the inner surface being finely toothed. The shell is markedly inequilateral, the posterior side being very short. A sharply defined keel is present, extending down from the umbo to the ventro-posterior angle. The surface

of this keel and the area immediately in front of it are strongly concentrically ridged while the area behind the keel is closely decussated with radial and transverse ridges. The lower margin is finely crenulated in correspondence with the fine teeth on the margin of the inner surface, and this crenulation is specially well marked towards the posterior margin. The surface in front of the strong, transversely ridged keel appears practically smooth, but on close examination it is found to be finely radially striated. The outer surface is almost whitish, with a few ash-coloured concentric bands. The inner surface is smooth, glossy and whitish, with a violet patch at the posterior margin. Pamban.

Donax aperittus Melvill.

Plate XXII, fig. 8.

Donax aperittus, Melvill, Mem. Proc. Manch. Lit. & Phil. Soc., XLI (7), 1897, p. 24; pl. vii, fig. 33.
Donax aperittus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 57.

The shell is very small, rather delicate and proportionately far more transversely elongate than in any of the preceding species of *Donax*. The shell is inequilateral, but the umbo is not placed so far behind as in most of the other Pamban species. The anterior margin of the shell is rounded and narrower than the posterior margin which is strongly oblique. The surface of the shell appears, on casual observation, smooth and glossy, except near the hind margin where it is strongly radially ridged, but on closer examination, the rest of the surface of the shell is also seen to be faintly sculptured with fine, decussating striae. The margin of the inner surface is distinctly toothed. The shell is more or less uniformly whitish. Pamban.

Family SEMELIDAE.

The shell is generally rounded or ovate, with a ligament carrying a more or less stout nodule, accommodated in an internal cavity situated just behind the cardinal teeth. The hinge usually bears one or two cardinal teeth, and often lateral teeth in addition.

Only a single genus, *Semele*, is represented at Pamban.

Genus **Semele** Schumacher, 1817.

(Syn. **Amphidesma** Lamarck, 1818).

The shell is rounded or oval, somewhat gaping at the anterior and posterior margins, often fairly thick and with more or less strong, concentric ridges and usually much finer radial sculpture in the interstices between them. The ligament is small and carries a nodule placed in an obliquely elongated pit. The hinge always bears two small cardinal teeth and also lateral teeth. The pallial sinus is large.

This genus is represented at Pamban by three species which may be distinguished as follows :—

1. Shell just as high as long, posteriorly somewhat bluntly angulated, angle being far above the level of the middle of the shell. Interstices between concentric ridges more or less uniform in width throughout the surface of the shell	2
— Shell decidedly longer than high, posteriorly more sharply angulated, angle relatively a little nearer the middle. Interstices between the concentric ridges at the umbo considerably wider than those between the ridges on the rest of the surface ..	*S. casta.*
2. Shell rounded, orbicular, concentric ridges somewhat close together. Interstices between the ridges finely radially striated. Anterior side nearly as long as the posterior	*S. crenulata.*
— Shell more squarish in outline, more or less obtusely angulated at the ventro-posterior corner. Concentric ridges more widely spaced. Interstices between the principal ridges traversed by much finer concentric striae. Anterior side much shorter than the posterior	*S. striata.*

Semele crenulata (Sowerby).

Plate XXII, figs. 9*a* and 9*b*.

Amphidesma crenulatum, Sowerby, Catal. *Amphidesma*, Conch., III, 1833, No. 16, (Spec. Conch., fig. 13).
Amphidesma crenulatum, Catlow & Reeve, Conch. Nomencl., 1845, p. 17.
Amphidesma crenulatum, Reeve, Conch. Icon., VIII, 1855, *Amphidesma*, pl. ii, fig. 8.
Amphidesma crenulata, Hanley, Conch. Misc., 1845–58, pl. i, fig. 9.
Amphidesma crenulata, Fischer, P., Journ. de Conchyl., VII, 1859, p. 335.
Amphidesma crenulata, E. v. Martens in Mobius, Beitr., Meeresf., Mauritius, 1880, p. 328.
Semele crenulata, Herdman, Ceylon Pearl Oyster Reports, V, 1906, Mollusca, p. 294.
Semele crenulata, Hedley, Mar. Fauna Queensland, Australas. Ass. Adv. Sc., 1909, p. 350.
Semele crenulata, Lamy, Pelecyp. Maurice, Bull. Mus. d'Hist. Nat. Paris, 1911, p. 133.
Semele crenulata, Lamy, Journ. de Conchyl., LXI, 1913, p. 347.

The shells of this and the next species roughly resemble that of a *Dosinia* in shape and general appearance, but differ greatly from it in details of sculpture and character of the hinge and ligament. The shell of *Semele crenulata* is moderately large, thick, rounded, being just about as high as long and almost equilateral. The small pointed umbo is placed more or less centrally. The anterior and posterior sides slope down from the umbo and

form an angle where they meet the anterior and posterior margins. The posterior angle, however, is sharper and placed a little higher than the level of the anterior angle. The sculpture consists of strong, raised, fairly close-set, concentric ridges, which, on close examination with a lens, are found to bear minute crenulations on the surface and somewhat uneven edges. The deep, channel-like interstices between the concentric ridges are very closely and minutely radially ridged. The hinge teeth, ligament and pallial sinus are as stated in the generic description. The shell is dull yellowish white. Pamban.

Semele casta A. Adams.

Plate XXII, figs. 10*a* and 10*b*.

Semele casta, Adams, A., Proc. Zool. Soc. London, 1853, p. 96.
Amphidesma casta, Reeve, Conch. Icon., VIII, 1855, *Amphidesma*, pl. iii, fig. 18.
Semele casta, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 118.
Semela casta, Hedley, Mar. Fauna Queensland, Australas. Ass. Adv. Sc., 1909, p. 350.
Semele casta, Lamy, Journ. de Conchyl., LXI, 1913, p. 343.

The shell is slightly smaller than in the preceding species and definitely longer than high. It is slightly inequilateral, the umbo being placed a little behind the middle line. The dorsal margin behind the umbo is almost straight, sloping and meets the rounded posterior margin at a more or less sharp angle. The dorsal margin in front of the umbo is slightly concavely depressed. The sculpture resembles that of *S. crenulata* in consisting of a number of strong, minutely folded concentric lamellae separated by deep interstices which are finely radially striated, but differs from it in the interstices between five or six of the ridges near the umbo being definitely wider and relatively smoother than those of the rest of the shell. The positions of the external concentric ridges are indicated on the smooth inner surface of the shell by faint whitish lines. The shell is dull white, faintly tinged with pale yellowish brown. Pamban.

Semele striata (Rüppell).

Plate XXII, figs. 11*a* and 11*b*.

Amphidesma striata, Rüppell MSS., Reeve, Conch. Icon., VIII, 1855, *Amphidesma*, pl. vii, fig. 46.
Cumingia Deshayesiana, Vaillant, Journ. de Conchyl., XIII, 1865, p. 126, pl. vi, fig. 2.
Cumingia Deshayesiana, Issel, Malac. mar. Rosso., 1869, p. 55.
Cumingia Deshayesiana, Fischer, P., Journ. de Conchyl. XIX, 1871, p. 217.
Semele fraxisa, De Gregorio, Studi Conch. Medit., Bull. Soc. Malac. Ital., X, 1884, p. 137.
Semele (Amphidesma) striata, Anthony, Moll., Tadjourah, Bull. Mus. d' Hist. Nat. Paris, XI, 1905, p. 496.
Semele striata, Lamy, Bull. Mus. d' Hist. Nat. Paris, XVIII, 1912, p. 316.
Semele striata, Lamy, Journ. de Conchyl., LXI, 1913, p. 365.

The shell of this species is readily distinguished from those of the two preceding species by its outline being less evenly rounded and more squarish, and by the absence of radial striae in the interstices between the concentric ridges. It is also more markedly inequilateral, the anterior side being much shorter. The posterior margin is somewhat straight

and obliquely truncated, while the anterior margin is broadly rounded. The sculpture consists of thin, but strongly raised concentric lamellae, somewhat widely spaced, but they are not minutely frilled as in the preceding species. The broad, flat interstices between the ridges are finely concentrically striated. The shell is markedly inflated, moderately thick, and both the inner and outer surfaces are whitish. Pamban.

Family TELLINIDAE.

The shell is usually thin, whitish, oval, sometimes transversely elongated and the hind margin more or less distinctly beaked. The surface of the shell is smooth or irregularly sculptured. The ligament is external, and the right valve bears lateral teeth in addition to the cardinals. The pallial sinus is very large, and its lower border is often found to coalesce with the portion of the pallial line immediately below it. The foot is byssiferous.

This family includes the paper shells and is represented at Pamban by a single genus, *Tellina*.

Genus **Tellina** Linné, 1758.

The shell is moderately large, rather compressed and more or less transversely elongated. The lower end of the hind margin of the shell is almost always somewhat pointed and angular. The front margin is broadly rounded. The left valve bears a single cardinal tooth and the right two, the latter usually having elongated lateral teeth in addition. The pallial sinus is large, very deep and extensive.

This genus is represented at Pamban by five species, which may be recognized with the aid of the following key. The Madras area has, however, yielded a much larger number of species of *Tellina*, partly due to more intensive collecting on the sandy beaches.

1. Surface of shell with a more or less distinct radial keel running near the posterior margin of the shell. Portion of the surface behind this keel somewhat more strongly striated than the rest of the surface. 2

— No such keel present. Sculpture, if present, of uniform strength throughout the surface 3

2. Shell large, with conspicuous concentric growth lines. Umbo definitely posterior. Hind margin not pointed and beak-like .. .. *T. angulata.*

— Shell smaller and thinner, with regular, microscopic concentric striae throughout the surface. Umbo nearly medial. Hind margin very distinctly pointed and beak-like .. .. *T. ala.*

3. Shell very thin, fragile and somewhat translucent. Surface almost smooth and shining. Shell pinkish and very much elongated transversely .. *T. scalpellum.*

— Shell thicker and larger, whitish and opaque. Surface of shell with more or less strongly developed concentric growth lines. Shell fairly high and rounded, and not appreciably elongated transversely 4

4. Shell thick, rather solid. Upper margin of shell behind the umbo strongly arched and sloping steeply down. Shell without any radial depression about the middle .. .. *T. bruguièri.*

— Shell thinner and more fragile, comparatively. Upper margin of the shell behind the umbo less strongly arched and sloping much less steeply. Shell with a feeble, but distinct radial depression the site of which is marked by a slight indentation in the ventral margin .. .. *T. coarctata.*

Tellina coarctata Philippi.

Plate XXIII, figs. 1*a* and 1*b*.

Tellina coarctata, R.A. Philippi, Zeitschrift f. Malakozool., 1845, p. 151, No. 11.

Tellina lacunosa (non Chemnitz), Hanley, in Sowerby, Thes. Conchyl., I, 1846, p. 322, No. 197, pl. xv, fig. 252.

Tellina lacunosa (non Chemnitz), Reeve, Conch. Icon., XVII, 1867, , *Tellina*, pl. vi, fig. 25.

Tellina (*Metis*) *lacunosa*, (non Chemnitz), Romer, in Martini-Chemnitz., Conch. Cab., X, 4 Abth., 1871, p. 201, No. 120 ; pl. xxxviii, figs. 10 to 12.

Tellina (*Metis*) *coarctata*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 109.

Tellina (*Metis*) *coarctata*, Lamy, Bull. Mus. d'Hist. Nat. Paris, XXIV, 1918, p. 168.

The shell is rather large, moderately thin and inflated, with the umbo placed definitely posterior to the middle line. The most characteristic feature of this shell is the broad, shallow, but distinct radial depression extending from the umbo down to the ventral margin. Strictly, the shell is keeled, but unlike those of *T. ala* and *T. angulata*, the keel in this species is so obtuse and broadly rounded that instead of being distinctly demarcated, it appears simply as a natural elevation following the depression just behind the middle line. The posterior margin is broad and somewhat angular below, while the front margin is narrower and more evenly rounded. The umbo is large, deep and conspicuously raised. The hinge bears two thick cardinal teeth, but no lateral teeth. The shell is whitish, and its outer surface is finely concentrically striated throughout. The interior is smooth and white. Kundugal Point and Pamban.

Tellina angulata Gmelin.

Plate XXIII, figs. 2*a* and 2*b*.

Tellina angulata, Gmelin, Syst. Nat., Ed. XIII, 1791, p. 3229, No. 4.
Tellina edentula, Reeve, Conch. Icon., XVII, 1870, *Tellina*, pl. xxviii, fig. 153.
Tellina angulata, Gravely (non Chemnitz), Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 60.

This species is by far the commonest of the five species of *Tellina* recorded from Pamban. Empty valves of this species may be found washed up on the beaches in fairly large numbers in the Pamban area, particularly on the mud flats at Kundugal Point. The shell is fairly large, thin, whitish, and of an oblong-ovate form, with the umbo placed well behind the middle line. Both the anterior and posterior parts of the dorsal margin slope obliquely from the umbo, but the posterior side is much shorter and is more steeply inclined than the anterior. The front margin is broad and rounded while the hind margin is slightly narrower and more truncated. The shell bears a more or less distinct, convexly raised, oblique radial keel running down from the umbo near the posterior margin, and the slight flexion of the surface of the shell in the region of the keel renders the ventral margin of the shell slightly but distinctly indented at the point of termination of the keel. The concentric growth lines which traverse the surface of the shell are generally stronger and more well marked over the keel and on the area behind it. The valves are moderately deep and appear most strongly inflated in the region immediately below the umbo. The hinge area is flattened and triangular and bears only two cardinal teeth, the lateral teeth being absent. The shell is moderately thin, smooth and without definite sculpture, apart from the usual growth lines. The inner surface is slightly glossy, and the pallial sinus is very large, deep and extensive. Kundugal Point and Pamban.

Tellina ala Hanley.

Plate XXIII, figs. 3*a* and 3*b*.

Tellina ala, Hanley, Proc. Zool. Soc. London, 1844, p. 165.
Tellina ala, Reeve, Conch. Icon., XVII, 1870, *Tellina*, pl. xxvii, fig. 144.
Tellina ala, Kuster, Conch. Cab., X, 1872, pl. 45, fig. 567.
Tellina ala, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 106.

This is another fairly well represented species of *Tellina* collected at Krusadai. Living specimens have been found burrowing into the soft sand at Watchman's Bay on the shore of Krusadai Island. Dead shells are also frequently found washed up on the beach, but as the shell is rather fragile, they are almost always found in a broken condition. The shell is readily distinguished from that of the preceding species by its smaller size, less strongly inflated valves and by the hind margin being pointed and beak-like. Except for the angular hind margin, the shell bears a very regular and evenly rounded outline. As in the preceding species the shell bears a radial keel just beside the posterior margin, preceded by a slight depression in the surface of the shell, but the sculpture is relatively less emphasized in the

region of the keel than in the corresponding area of the surface in the shell of the preceding species. The anterior margin is very broad and rounded, while the hind margin is narrow, attenuated and terminates in a short, pointed, beak-like rostrum, which marks the site of the lower termination of the keel. The umbo is nearly medial and the dorsal margin behind it slopes obliquely, while it is almost horizontal in front of the umbo. The ventral margin bears a slight, but distinct indentation just in front of the keel. The surface of the shell is uniformly traversed by regular, very fine, close-set, almost microscopic, concentric striae which render the surface more or less glossy. The umbo is small, sharply pointed and slightly inclined posteriorly. The pallial sinus is very large and deep. The shell is white, occasionally with a horny brown tinge towards the margins. In fresh shells a pale orange streak may be observed on either side of the umbones. Pamban and Krusadai Island.

Tellina bruguièri Hanley.

Plate XXIII, figs. 4*a* and 4*b*.

Tellina Bruguièri, Hanley, Proc. Zool. Soc. London, 1844, p. 142.
Tellina Bruguièri, Reeve, Conch. Icon., XVII, 1870, *Tellina*, pl. xxx, fig. 165.
Tellina bruguièri, Dall, Proc. U.S. Nat. Mus., XXIII, 1900, p. 292.
Tellina bruguièri, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 61.

The shell of this species is by far the thickest among those of the Pamban species of *Tellina* and is readily distinguished from the others by the almost entire absence of a radial keel near the hind margin, and by the shell being only very slightly longer than high. The shell is thick, solid, moderateley inflated and of a somewhat triangularly rounded outline, with a broad, rounded front margin, and with the dorsal margin behind the umbo sloping steeply down, leading on to the short and truncated hind margin. The ventral margin is obliquely inclined upwards as it approaches the hind margin. The surface of the shell is traversed by very fine, close-set, concentric ridges and much fainter radial striae. The umbo is small, but fairly deep and prominent and the dorsal margin behind it is deeply depressed. The cardinal teeth are strong and separated from the shell margin on either side by deep clefts. The pallial sinus is very broad, its dorsal border reaching a level much above the middle of the shell. The shell is pale yellowish brown, indistinctly banded with darker brown. Pamban.

Tellina scalpellum Hanley.

Plate XXIII, fig. 5.

Tellina scalpellum, Hanley, Proc. Zool. Soc. London, 1844, p. 147.
Tellina scalpellum, Reeve, Conch. Icon., XVII, 1870, *Tellina*, pl. xlviii, fig. 289.

The shell of this species is smaller, much thinner and far more fragile than in any of the four preceding species of *Tellina*. The shell is relatively more strongly transversely elongate, being nearly twice as long as high. The umbo, though placed definitely posterior to the

middle line is still at a considerable distance away from the hind end. The hind margin is narrow, pointed and somewhat beaked, while the front margin is moderately broad and rounded. There is hardly any keel near the posterior margin. The ligamentary area is small, but distinct. The surface is almost smooth and even slightly glossy. The shell is pale pinkish throughout. This species is represented in the Museum collection by a single young shell from Pamban, but unfortunately this shell is in a slightly broken condition. Pamban.

Sub-Order Adapedonta.

SERIES SOLENACEA.

Family SOLENIDAE.

This family includes bivalves commonly known as razor shells, sunset shells and their allies. The shell is usually transversely elongate, and often very markedly so. The foot is large, stout and well developed, but devoid of a byssus. The siphons are usually short. The umbo is almost always placed near the front end of the shell. The animals generally live burrowing in the wet sand just within the shore line.

Two genera, *Solen* and *Siliqua* are represented at Pamban. The former is readily distinguished from the latter by the shell being far more strongly elongated and by the dorsal and ventral margins of the shell being straight and parallel to each other. Further, the shell is inflated and cylindrical in shape in *Solen*, while it is flattened and compressed in *Siliqua*.

Genus **Siliqua** Megerle von Muhlfeld, 1811.

The shell is thin, compressed and moderatley elongated. The front and hind margins of the shell are rounded and gaping. The hinge bears two teeth on the right valve and three on the left. The pallial sinus is united with the portion of the pallial line below. The inner surface of the shell bears a stout, whitish radial ridge extending from the umbo.

This genus is represented at Pamban by a single species, *Siliqua radiata*, the common sunset shell of the Indian shores. It has also been recorded from the Madras beach.

Siliqua radiata (Linné).

Plate XXIV, figs. 1*a* and 1*b*.

Solen radiatus, Linné, Syst. Nat., Ed. X, 1758, p. 673, No. 28, and Ed. XII, 1767, p. 1114, No. 38.
Solen radiatus, Chemnitz, Conch. Cab., VI, 1782, p. 54, pl. v, figs. 38–39.
Solen radiatus, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3225.

Solen radiatus, Lamarck, Anim. sans vert., 1818, p. 455.
Solen radiatus, Hanley, Cat. Recent Bivalve Shells, 1842, p. 14.
Machaera radiata, Chenu, Man. de Conchyl., II, 1862, p. 23, fig. 102.
Cultellus radiatus, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Cultellus*, pl. iv, fig. 13.
Machaera radiata, Clessin, in Martini-Chemnitz, Conch. Cab., XI, Bd. 3 Abth., 1888, pl. 59, No. 3, pl. v, figs. 9 to 11.
Siliqua radiata, Morlet, Journ. de Conchyl., XXXVII, 1889, p. 172, No. 86.
Siliqua radiata, E. v. Martens, Suss w. Brackwasser-Mollusken d. Ind. Archip., 1897, p. 260.
Siliqua radiata, Dautzenberg & Fischer, Journ. de Conchyl., LIV, 1906, p. 220.
Siliqua radiata, Lyngo, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 181.
Cultellus radiatus, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 194.
Siliqua radiata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 62, fig. 23e.

The shell is fairly large, thin, rather fragile, compressed, markedly elongate and transversely oblong in outline. It is strongly inequilateral, the umbo being placed much nearer the anterior end. The anterior and posterior margins are rounded, the former being slightly narrower than the latter. The dorsal margin behind and in front of the umbo is almost straight and roughly parallel to the ventral margin, which is slightly curved, sloping upwards towards the anterior margin. The surface of the shell is practically smooth, but on close examination, it is seen to be finely grooved with concentric striae and much fainter radial striae. The ligament is external. One of the most characteristic features of this shell is the presence of a stout, whitish radial ridge on the inner surface of each valve extending slightly obliquely down from the umbo and corresponding in position to the first white radial band on the outer surface. The inner surface is smooth and more glossy than the outer. The shell is bluish white or bluish violet, ornamented with four white radially expanding bands radiating from the umbo simulating the rays of the setting sun. It is to this last character that the shell owes its popular .name, 'sunset shell.' Only empty shells have so far been collected at Pamban. Pamban.

Genus **Solen** Linné, 1758.

The shell is greatly elongated, being several times longer than high, almost of a cylindrical shape and always truncated at the front end and usually also at the hind end. The umbo is placed very near the front margin and is often almost terminal. The hinge always bears a single tooth in each valve. The pallial sinus is squarish and truncated. The siphons are long. The foot is powerful, muscular, long and cylindrical. The animals rapidly burrow in the soft sand with the aid of the foot. The shells are commonly known as the razor shells.

Two species, *S. lamarckii* and *S. aspersus*, have been recorded from Pamban. The latter may be readily distinguished from the former by its much smaller and thinner shell which is slightly, but distinctly curved and more brightly coloured with spots and markings.

Solen lamarckii Deshayes.

Plate XXIV, fig. 2.

Solen Lamarckii, Chenu, Illustr. Conchyl., 1843–45, pl. 1, figs. 2, 3 and 4.
Solen Lamarckii, Sowerby, in Reeve, Conch. Icon., XIX, 1874, *Solen*, pl. iv, fig. 16.
Solen Lamarckii, Clessin in Martini-Chemnitz, Conch. Cab., XI, Bd. 3 Abth., 1888, p. 25, pl. viii, fig. 3.
Solen Lamarckii, Dautzenberg & Fischer, Journ. de Conchyl., LIV, 1906, p. 220.
Solen lamarckii, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 63, fig. 23b.

The shell is fairly large and thick, greatly elongated with straight upper and lower margins which are almost parallel to each other except towards the hind margin where they tend to converge slightly. The front margin is truncated and slopes slightly forwards as it approaches the lower margin. The hind margin is somewhat rounded above and below and slopes forwards from above downwards. The ventral and anterior portions of the surface are distinctly transversely striated while the dorsal and posterior portions of the surface are traversed by vertical striae which follow more or less closely the shape of the outline of the hind margin. It is these striae which are continued as the transverse striae of the lower and anterior parts of the surface. The single hinge tooth is placed very close behind the front margin. The shell is marked with a number of more or less distinct, pale purplish vertical bands arising from the dorsal margin. They are shortest at the anterior end, but gradually become longer, the longest ones being at the extreme hind portion of the shell. There is a single well marked vertical purplish band at the anterior margin. A single large left valve, somewhat worn out in the middle, is the only Krusadai specimen of this species represented in the Museum collection ; more specimens, however, have been collected in the Madras area. Broken fragments of the shell are not uncommon on the beaches at Krusadai and Kundugal Point. Krusadai Island.

Solen aspersus Dunker.

Plate XXIV, figs. 3*a* and 3*b*.

Solen aspersus, Dunker, Proc. Zool. Soc. London, 1861, p. 420.
Solen aspersus, Sowerby, in Reeve, Conch. Icon, XIX, 1874, *Solen*, pl. vii, fig. 32.

The shell is smaller and thinner than that of the preceding species and is slightly curved, the convexity of the curve being on the dorsal side as in all curved razor shells. The front margin is truncated and definitely sloping forwards from top towards the ventral margin. The hind margin is also truncated, but less sharply angular above and below than the front. The single hinge tooth is placed close behind the front margin in the left valve and almost at the margin in the right valve. In the fresh condition the shell is pale horny brown, mottled with purplish markings. Young shells are more brightly coloured and show the curvature more distinctly than full-grown ones. The few empty shells from Pamban represented in the Museum collection are rather worn, but still bear remnants of a horny brown periostracum. **Pamban.**

SERIES MYACEA.

Family ALOIDIDAE.

(= CORBULIDAE).

The shell is moderately small, somewhat inequilateral, with the valves closely pressed together. The hind margin is generally angular or even beak-like. The shell is usually strongly concentrically sculptured. The ledge for the ligamentary nodule is more or less projecting. The right valve bears a stout tooth in front of the nodule. This tooth and the ledge fit into corresponding cavities in the left valve. The pallial line is non-sinuate.

The genus *Aloides* (= *Corbula*) is represented at Pamban by two species.

Genus **Aloides** Megerle von Muhlfeld, 1811.

[Syn. **Corbula** (Bruguière) Lamarck, 1799].

The shell is inequivalve, the right valve being slightly larger and more strongly sculptured than the left. The shell is moderately small with a more or less well marked beak-like projection at the hind margin, and a markedly thickened edge. The pallial sinus is absent or only feebly developed.

Two species, *A. modesta* and *A. sulculosa,* are represented among the Pamban bivalves in the Museum collection. Of these, the former is much commoner and is distinguished from the latter by the shell being larger, more solid and bearing a characteristic sculpture, consisting of a few, thick, rounded concentric ribs with deeply excavated interstices.

Aloides modesta (Hinds).

Plate XXIV, figs. 4*a* and 4*b*.

Corbula modesta, Hinds, Proc. Zool. Soc. London, 1843, p. 57.
Corbula modesta, Reeve Conch. Icon., II, 1843, *Corbula*, pl. ii, fig. 14*a* and *b*.
Corbula modesta, Catlow & Reeve, Conch. Nomencl., 1845, p. 9.
Corbula modesta, Adams, H. & A., Genera of Recent Mollusca, II, 1856, p. 357.
Corbula modesta, Smith, " Challenger " Zoology, XIII, 1885, Lamellibranchiata, p. 32.
Corbula modesta, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 843.
Corbula modesta, Standen & Leicester, Ceylon Pearl Oyster Reports, V, 1906, p. 294.
Corbula modesta, Dautzenberg, Journ. de Conchyl., LVIII, 1910, p. 31.
Corbula modesta, Faustino, Summary Phillippine Mar. Freshw. Moll., 1928, p. 114.
Aloides modesta, Prashad, Siboga-Expeditie, Pelecypoda, Monogr., CXVIII, 1932, p. 308.
Aloides modesta, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 64.

This species is widely distributed in the Indo-Pacific Region. The shell is moderately small, thick, soild, rounded in front, pointed and beaked behind. The right valve is only slightly larger than the left, but the grooves separating the concentric ridges are appreciably deeper and more widely spaced than those of the left valve. A more or less distinct,

oblique keel extends down from the umbo near the posterior margin. The area behind this keel is a little smaller in the left valve than in the right. The areas of the two valves together form a well defined, large, asymmetrically oval space behind the umbo. The concentric ridges are strong and rounded, separated by deep grooves and are, in their turn, finely concentrically striated. The single hinge tooth in the right valve is stout, projecting, and fits into a corresponding pit in the left valve. The shell is pale brownish white, often with a pale violet tinge towards the umbo. The interior of the shell is smooth and yellowish brown. A few dead shells are represented in the Museum collection. Pamban.

Aloides sulculosa (H. Adams).

Plate XXIV, figs. 5*a* and 5*b*.

Corbula sulculosa, Adams, H., Proc. Zool. Soc. London, 1870, p. 6.

The shell is much smaller and much less strongly sculptured than in the preceding species. The front margin is rounded and the hind margin angular and pointed, but not so sharply beaked as in *A. modesta*. The right valve is somewhat larger than the left. The shell bears a distinct, oblique, radial keel near the posterior margin. The surface of the shell bears very fine, feebly developed, close-set, concentric ridges, but these are scarcely seen in the shells represented in the Museum collection, especially over the middle part, as these shells are rather worn. A prominent, rounded hinge tooth is present on the right valve, fitting into a corresponding depression in the left. The shell is whitish throughout, and very small, the largest in the collection measuring only about 5 mm. in length and 3 mm. in height from the umbo to the ventral margin. The few dead shells from Pamban contained in the Museum collection have both the valves intact, but are unfortunately somewhat worn out so that the sculptural details are obscured to a certain extent. Pamban.

SERIES GASTROCHAENACEA.

Family GASTROCHAENIDAE.

(= ROCELLARIIDAE).

The shell is more or less elongated, moderately small and gaping widely in the anterior portion of the ventral margin. The ligament is external and is mounted on a small, projecting ledge. The hinge is entirely toothless and the pallial sinus deep.

A single genus, *Gastrochaena*, is represented at Pamban.

Genus **Gastrochaena** Spengler, 1783.

(Syn. **Rocellaria** Blainville, 1828.)

The umbo is placed very near the narrow and pointed front end. The hind margin is rounded. The shell is uniformly concentrically sculptured. The impression of the anterior adductor muscle is small. The siphons are elongated and fused with each other . The foot is large and pointed in front. The shell is often more or less twisted. These bivalves bore into coral rock or shells of molluscs.

This genus is well represented at Pamban. The five species of *Gastrochaena* which have been recorded from Krusadai and the neighbouring collecting grounds may be distinguished as follows :—

1.	Shell with the ventral gape (hiatus) very wide and extending nearly to the hind end. Surface of shell strongly concentrically striated	3
—	Shell with the ventral gape relatively narrower and not extending to the hind end, closing a little distance away from it. Sculpture generally weaker and more variable	2
2.	Shell rather compressed and narrow. Ventral gape comparatively narrow. Surface of shell more or less uniformly sculptured with fine, concentric ridges.	*G. indistincta.*
—	Shell more strongly inflated, broader. Ventral gape comparatively wider. Surface of shell more strongly sculptured posteriorly with raised, thin, lamina-like concentric ridges. Anteriorly sculpture much weaker and finer	*G. lamellosa.*
3.	Shell somewhat thin, very finely concentrically striated throughout. Hind margin rather narrow. Surface traversed by a faint, but distinct, oblique, groove-like depression (more well marked posteriorly) extending diagonally across the shell from near the umbo to the ventro-posterior corner	*G. impressa.*
—	Shell thicker, more coarsely sculptured with concentric ridges. Hind margin relatively broader. Oblique depression across the surface absent ...	4

4. Shell larger. Outline of ventral margin strongly convexly rounded. Hind margin strongly rounded. Concentric ridges strong and densely arranged .. .. *G. gigantea.*

— Shell smaller, outline of ventral margin much straighter. Hind margin straighter and somewhat truncated. Concentric ridges weaker and less closely set .. .. *G. apertissima.*

Gastrochaena gigantea (Deshayes).

Plate XXIV, figs. 6*a* and 6*b*.

Fistulina gigantea, Deshayes, Encyclopédie Méthodique, II, 1830, p. 142.

Gastrochaena gigantea, Sowerby, in Reeve, Conch. Icon., XX, 1878, *Gastrochaena*, pl. iii, fig. 15*a* and *b*.

Gastrochaena lamellosa, Smith (non Deshayes), "Challenger," Zoology, XIII, 1885, Lamellibranchiata, p. 28, pl. vii, fig. 2.

Gastrochaena gigantea, Sowerby, Thes. Conchyl., V, 1887, p. 128, No. 4, pl. 470, fig. 12.

Gastrochaena gigantea, Clessin, in Martini-Chemnitz, Conch. Cab., XI, 4 Abth., a, 1894, p. 13, No. 22 ; pl. iv, figs. 8 and 9.

Rocellaria gigantea, Smith, Fauna and Geography of the Maldive and Laccadive Archipelagoes, II, 1903, p. 626.

Gastrochaena gigantea, Lamy, Bull. Mus. d'Hist. Nat. Paris, 1906, p. 207.

Gastrochaena gigantea, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 184.

Gastrochaena gigantea, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 65.

This species is recorded also from the Madras area, and is represented in the Museum collection by dead shells as well as specimens with their soft parts intact, collected from coral rock at Pamban and preserved in alcohol. The shell is fairly large and thick, narrow and pointed at the front end and evenly rounded behind. The surface is traversed by strong close-set concentric ridges. The ventral hiatus is very broad and extends up to the hind end of the shell. The profile of the ventral margin is characteristic. It is convexly rounded and ascends obliquely up towards the front end, near which it becomes slightly concave. The inner surface is smooth and glossy.

There has been considerable confusion regarding the nomenclature of this and some of the succeeding species of *Gastrochaena* recorded from Pamban. Specimens identified as *G. lamellosa* by Smith in the Challenger Reports (*loc. cit.*) have been correctly referred by Lynge to the present species. Some authors have confused *G. dubia* with *G. gigantea* but the latter is distinct and is distinguished by its larger size and more prominent longitudinal striation over the entire surface.

On the reefs in and around Krusadai Island living specimens have been collected from coral rock into which they bore and make a flask-shaped cavity, the interior of which is practically smooth. Krusadai Island and Pamban.

Gastrochaena apertissima (Deshayes).

Plate XXIV, figs. 7*a* to *d*.

Gastrochaena apertissima, Deshayes, Proc. Zool. Soc. London, 1854, p. 326.
Gastrochaena apertissima, Sowerby in Reeve, Conch. Icon., XX, 1878, *Gastrochaena*, pl. i, fig. 4.
Gastrochaena apertissima, Hidalgo, Estud. Prelim. Faun. Malacol. Filip., 1903, p. 12.
Gastrochaena apertissima, Lamy, Journ. de Conchyl., LXVIII, 1923, pp. 68 and 301.
Rocellaria apertissima, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 108.

The specimens of this species represented in the Museum collection have been collected from crevices in coral rock at Pamban. The shell is smaller and less strongly sculptured than that of the preceding species. The ventral margin is almost straight and the hind margin is much straighter than in the preceding species, and appears more or less truncated, the lower end of the hind margin being rather angular. The shell is less strongly inflated than in *G. gigantea*. The surface is finely concentrically striated throughout, but the striae are not so raised and densely set as in the preceding species. The ventral gape is wide and extends nearly to the posterior end. Rameswaram and Pamban.

Gastrochaena lamellosa (Deshayes).

Plate XXIV, figs. 8*a* and 8*b*.

Gastrochaena lamellosa, Deshayes (non Smith, "Challenger," 1885, p. 28), Proc. Zool. Soc. London, 1854, p. 328.
Gastrochaena lamellosa, Sowerby, in Reeve, Conch. Icon., XX, 1878, *Gastrochaena*, pl. iii, fig. 14.
Gastrochaena lamellosa, Hidalgo, Estud. Prelim. Faun. Malacol., Filip., 1903, p. 9.
Gastrochaena lamellosa, Lamy, Journ. de Conchyl., LXVIII, 1923, p. 298.
Rocellaria lamellosa, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 108.

The shell is moderately large and comparatively less inflated, but more elongated than in *G. gigantea*. The general shape of the outline of the shell, however, very closely resembles that of *G. gigantia*, being almost equally inflated at the two extremities and with the ventral margin very nearly parallel to the dorsal margin. The front end is narrow and pointed and the ventral and hind margins evenly rounded. The sculpture consists of thin, fairly close-set concentric laminae with deep, channel-like grooves between them. These laminae are strongly developed only on the posterior two-thirds of the surface, the anterior part of the surface near the umbo being traversed only by very fine, inconspicuous concentric striae. The ventral gape is moderately broad, but relatively narrower than in the preceding species, and does not reach up to the hind margin, closing down well in front of it. Pamban.

Gastrochaena indistincta (Deshayes).

Plate XXIV, figs. 9*a* and 9*b*.

Gastrochaena indistincta, Deshayes, Proc. Zool. Soc. London, 1854, p. 328.
Rocellaria indistincta, Adams, H. & A., Genera of Recent Molluscs, II, 1856, p. 336.
Rocellaria indistincta, Tryon, Proc. Acad. Nat. Sci. Philadelphia, XIII, 1861, p. 482.

Gastrochaena indistincta, Smith, Proc. Zool. Soc. London, 1891, p. 395.
Gastrochaena cuneiformis (pars), Hidalgo, Estud. Prelim. Fauna Malacol. Filip., 1903, p. 10.
Gastrochaena indistincta, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 185.
Gastrochaena cuneiformis (pars), Lamy, Journ. de Conchyl., LXVIII, 1923, p. 295.

There has been considerable confusion regarding the synonymy of this species. Lamy (*loc. cit.*) considers that *G. dubia* Issel (*non* Pennant), *G. gigantea* Deshayes, *G. lamellosa* Smith (non Deshayes) and *G. indistincta* Deshayes are all synonymous with *G. cuneiformis* Spengler. But in view of the several marked differences in size, form and sculpture Lynge (*loc. cit.*) differs from this view and regards *G. indistincta* of Deshayes as distinct from *G. gigantea* Deshayes and *G. lamellosa* Smith, the last two species being synonymous. As the Pamban specimens of the Museum collection which have been identified as *G. indistincta* are easily distinguished from *G. gigantea* by the truncated posterior margin and finer sculpture, I have followed Lynge in treating these two as distinct species in the present account.

The shell is elongately ovate, rather thin and narrow, with a more or less truncated posterior margin. The surface of the shell is traversed by concentric striae which are fine and uniformly close-set in the anterior portion of the shell, while in the middle and posterior portions, they are less regularly spaced, raised and lamina-like, somewhat as in *G. lamellosa*. The ventral hiatus is comparatively narrow and elongated, but does not reach up to the hind margin, closing down well in front of it. Krusadai Island.

Gastrochaena impressa (Deshayes).

Plate XXIV, figs. 10*a* to *c*.

Gastrochaena impressa, Deshayes, Proc. Zool. Soc. London, 1854, p. 327.
Gastrochaena impressa, Sowerby, in Reeve, Conch. Icon., XX, 1878, *Gastrochaena*, pl. iv, fig. 23.
Gastrochaena impressa, Lamy, Journ. de Conchyl., LXVIII, 1923, p. 304.

The specimens doubtfully referred to as *Rocellaria philippinensis* in the previous published list of Krusadai Mollusca (*Bull. Mad. Govt. Mus. Nat. Hist.*, I, No. 1, 1927, p. 108) have been later correctly identified as *Gastrochaena impressa*. The shell is oblong-ovate, narrow anteriorly and broader posteriorly, and thinner than that of any of the preceding species of this genus. The shape of the outline of the ventral and hind margins resembles somewhat that of *G. apertissima*, though it is slightly more rounded in the present species. The surface of the shell is finely concentrically striated, the striae being uniformly developed throughout. There is a slight but distinct depression extending across the surface from the umbo to the hind end of the lower margin, and particularly well marked posteriorly. Along the site of this oblique depression there is a slight overlapping of the striae. The ventral hiatus is broad and elongated, extending to the hind end of the shell. Rameswaram.

SERIES ADESMACEA.

Family PHOLADIDAE.

This family includes bivalves known as Piddocks which bore into wood or stone. The shell is variable in size, usually more or less elongated, gaping in front and behind, often wide open at the front margin. The upper surface is traversed by toothed ribs, which, however, are either very feebly developed or completely absent from the hind portion of the shell. The anterior part of the dorsal margin is folded up above the outer surface. The dorsal margin is provided with one or more accessory calcareous plates. The pallial sinus is more or less deep. The hinge margin and ligament are absent.

The Pamban specimens of Pholadidae represented in the Museum collection belong to four different genera which may be distinguished as follows :—

1. Shell globular, almost spherical, inequivalve, valves divided by a furrow into a larger anterior and a smaller posterior portion .. .. .. *Jouannetia.*

— Shell not as above 2

2. Shell large, very greatly elongated, generally with the strong, radial sculpture of the anterior part abruptly terminating a little beyond the middle, leaving the posterior part of the surface smooth .. .. *Pholas.*

— Shell much smaller, proportionately less markedly elongate. Sculpture usually consisting of transverse striae, stronger anteriorly, becoming weaker posteriorly and almost absent from the extreme posterior part 3

3. Shell only slightly elongate, much inflated anteriorly ; upper part of the surface with undulating concentric striae. Lower part smooth or indistinctly sculptured .. .. *Pholadidea.*

— Shell moderately elongate, not so markedly inflated anteriorly, thin, always with a radial furrow extending downwards from the umbo. Transverse striae strongly developed anterior to this furrow and extends over a greater part of this area, being absent only from the extreme ventral part .. .. *Martesia.*

Genus **Pholas** Linné, 1758.

(Syn. **Dactylina** Gray, 1847).

The shell is greatly elongate, narrowed posteriorly with the hind portion of the surface more or less smooth and abruptly demarcated from the strongly sculptured anterior portion. The dorsal margin is covered by two calcareous accessory plates. The interior of each valve bears an arched process below the umbo. The pallial sinus is large.

A single species, *Pholas orientalis*, which is well represented on the Madras Coast, has been recorded from Pamban, but only dead shells of this species have so far been collected from this locality.

Pholas (Monothyra) orientalis Gmelin.

Plate XXV, fig. 1.

Pholas orientalis, Gmelin, Syst. Nat., Ed. XIII, 1790, p. 3216, No. 7.
Pholas orientalis, Lamarck, Anim, sans vert., V, 1818, p. 444, No. 2, Ed. 2, VI, p. 44, No. 2.
Pholas orientalis, Catlow & Reeve, Conch. Nomencl., 1845, p. 4.
Dactylina orientalis, Gray, Ann. & Mag. Nat. Hist., Ser. 2, VIII, 1851, p. 382.
Pholas orientalis, Sowerby, Thes. Conchyl., II, 1855, p. 486, No. 4, pl. 102, fig. 3–4.
Monothyra orientalis, Tryon, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 205.
Dactylina orientalis, Chenu, Man. de Conchyl., II, 1862, p. 5, fig. 16.
Pholas orientalis, Reeve, Conch. Icon., XVIII, 1873, *Pholas*, pl. ii, fig. 5.
Phragmopholas orientalis, Morlet, Journ. de Conchyl., XXXVII, 1889, p. 173, No. 91.
Pholas (Dactylina) orientalis, Clessin, in Martini-Chemnitz, Conch. Cab., XI, 4 Abth., 1894, p. 12, No. 6, pl. ii, figs. 3–4.
Pholas (Monothyra) orientalis, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, pl. 186.
Dactylina orientalis, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 195.
Pholas (Monothyra) orientalis, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 66.

The shell is large, elongated, white, and rather thin and fragile for its size, and narrowed posteriorly. It gradually widens towards the umbo, reaching the maximum height at the umbo and again narrows down rapidly, terminating in the narrowly rounded front margin. The dorsal margin of the shell is reflected a little over the upper surface about the umbo, and the narrow space between this reflected fold and the upper margin is cut up into small segments by thin vertical calcareous walls. The sculpture consists of a series of strong, nodular, radial, ribs traversing the anterior part of the shell, uniformly well developed as far as it goes, but terminating abruptly just a little beyond the middle, leaving the posterior part of the surface quite smooth, except for the faint, concentric growth striae. The shell being strongly inequilateral and greatly elongated, the radial ribs, which are practically rows of tubercles, rounded at the upper part, but transversely elongated towards the ventral margin, become increasingly oblique as they recede from the umbo posteriorly. There are two dorsal accessory plates. The shell is uniformly pure white and strongly inflated, especially anteriorly. Pamban.

Genus **Martesia** (Leach) Blainville, 1825.

The shell is usually moderately small and thin, always with a radial furrow running down from the umbo. It is ovoid and considerably inflated. In addition to the dorsal accessory plates there is a ventral plate. The valves often bear a thin calcareous process on the interior, suspended from near the umbo. The siphons are long and united.

Only a single identified species of this genus from Pamban is represented in the Museum collection.

Martesia striata (Linné).[1]

Plate XXV, figs. 2*a* to *c*.

Pholas striatus, Linné, Syst. Nat., Ed. X, 1758, p. 12, Ed. XII, 1767, p. 1111, No. 22.

Pholas striata, Catlow & Reeve, Conch. Nomencl., 1845, p. 4.

Martesia striata, Gray, Proc. Zool. Soc. London, 1847, p. 188.

Pholas striata and *teredinaeformis*, Sowerby, Thes. Conchyl., II, 1855, p. 494, No. 29, pl. 104, figs. 40–42; pl. 105, figs. 43 and 44, and p. 490, pl. 108, figs. 97 and 98.

Martesia striata, Adams, H. & A., Genera of Recent Mollusca, II, 1856, p. 330, pl. 90, fig. 5.

Pholas striata, Fischer, P., Journ. de Conchyl., VIII, 1860, p. 337.

Martesia striata, Chenu, Man. de Conchyl., II, 1862, p. 9, figs. 48–50.

Martesia striata, Tryon, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 220.

Pholas striata and *teredinaeformis*, Sowerby, in Reeve, Conch. Icon., XVIII, 1873, *Pholas*, pl. vii, fig. 32; pl. ix, fig. 36.

Martesia striata, Clessin, in Martini-Chemnitz, Conch. Cab., XI, 4 Abth., 1894, p. 45. No. 13, pl. x, figs. 2–3, 7–8.

Martesia striata, Dunker, Index. Moll. Mar. Japonicum, 1882, p. 171.

Martesia striata, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 27.

Martesia striata, Melvill & Standen, Mar. Moll. Madras, Journ. of Chonchology, IX, 1898, p. 84.

Pholas (*Martesia*) *striata*, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 187.

Pholas (*Martesia*) *striata*, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 196.

Martesia striata, Lamy, Journ. de Conchyl., LXIX, 1925, p. 194.

Martesia striata, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 22.

This species is widely distributed in the Indo-Pacific Region, and the great degree of variation to which the form of the shell is subjected has been partly responsible for the widely different names by which this species had been known to various authors. This is a small bivalve generally boring into pieces of floating timber. Small pieces of decaying wood bored by a number of these shells occasionally get washed up on the beach. The animal makes a neat, almost cylindrical crevice in which it lodges itself. The shell is inflated, moderately elongated, narrowed posteriorly and traversed by a slightly oblique radial furrow running down from the umbo. The portion of the surface anterior to this furrow is strongly obliquely ribbed, the ribs being close-set, serrated and markedly bent at an obtuse angle a little distance behind the front margin. A small portion of the surface adjoining the antero-ventral border, however, is quite smooth. The area of the surface behind

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[1] Besides *P. teredinaeformis*, referred to in the above list of references, *P. pusillus*, Linné, *P. nana* Pulteney, *P. clavata* Lamarck, *P. conoides* Fleming, *P. fulcata* Wood, *P. semicostata* Lea and *P. xylophaga* (Valenciennes) are all synonymous with *Martesia striata*, but the references are too numerous to be included in the above list.

the furrow is feebly concentrically striated. The striae become weaker posteriorly, the extreme posterior part of the shell being almost smooth. There is a narrow, elongated ventral plate and two dorsal plates, a wide anterior one placed over the umbo and a narrow elongated posterior one. Pamban.

Martesia sp.

There are a few specimens belonging to the genus *Martesia* in the Museum collection, some of which are much larger than those of the preceding species, collected from coral rock at Pamban, the specific identification of which is uncertain. In shape the shell is intermediate between those of the preceding species and the following species, *Jouannetia cumingii*, being definitely more strongly inflated and less elongated than in *M. striata*. The shell is ovoid, with an evenly rounded outline, a broad anterior margin, and a narrower posterior margin. The shell is traversed in the middle by a vertical, fairly wide, but shallow, canal-like furrow, which, on close examination, is observed to be transversely ridged. The portion in front of this furrow is traversed by fine, oblique, close-set, slightly undulating ridges, which, however, are absent from a small area bordering the antero-ventral margin. The portion behind the furrow is finely concentrically striated for some distance, the extreme hind part being smooth. The specimens closely approach Reeve's figure and description of *Pholas ovoidea*, but further material is necessary to confirm the identification. Pamban.

Genus **Jouannetia** Des Moulins, 1828.

The shell is globular, almost spherical, the right valve being porduced posteriorly into a rostriform appendage and divided by a vertical furrow into a large anterior and smaller posterior portion, the latter being traversed by more or less undulating concentric ridges. The anterior part is also sculptured, but less distinctly. The pallial sinus is angular and pointed. The foot is rudimentary.

Two species from Pamban, namely *J. globulosa* and *J. cumingii*, are represented in the Museum collection. The former is readily distinguished from the latter by the shell being less perfectly spherical, comparatively small, and more or less ovoid. It is also distinguished from that of *J. cumingii* in that the edge of the posterior prolongation of the right valve is beset with sharp, recurved teeth.

J. globulosa is represented in the Musuem collection by a single dead shell with both the valves intact, and *J. cumingii* by a few spirit-preserved specimens with the soft parts *in situ*.

Jouannetia globulosa (Quoy & Gaimard).

Plate XXV, figs. 3*a* and 3*b*.

Pholas globulosa, Quoy & Gaimard, Voy. " Astrolabe ", Zool., III, 1834, p. 49, pl. 85, figs. 16 to 19.
Triomphalia globosa, Sowerby, Proc. Zool. Soc. London, 1849, p. 60, pl. v, fig. 1.
Triomphalia globosa, Sowerby, Thes. Conchyl., II, 1849, p. 501 ; pl. cvi, figs. 54 and 55.
Jouannetia globosa, Gray, Ann. & Mag. Nat. Hist. Ser. 2, VIII, 1851, p. 382.
Jouannetia globosa, Fischer, P., Journ. de Conchyl., VII, 1858, p. 51.
Jouannetia globosa, Chenu, Man. de Conchyl., II, 1862, p. 7, fig. 36.
Jouannetia globosa, Tryon, Proc. Acad. Nat. Sci. Philadelphia, XIV, 1862, p. 216.
Pholas globosa, Sowerby, in Reeve, Conch. Icon., XVIII, 1873, *Pholas*, pl. xi, fig. 42.
Jouannetia globulosa, Hidalgo, Estud. Prelim. Fauna Malacol. Filip., 1903, p. 4.
Jouannetia globosa, Hedley, Mar. Fauna Queensland, Australas. Assoc. Adv. Sci., 1909, p. 351.
Jouannetia (Triomphalia) globulosa, Lamy, Journ. de Conchyl., LXIX, 1925, p. 218.

As usual in the genus *Jouannetia*, the shell is globular but distinctly less perfectly spherical than in the next species, being slightly ovoid in shape. Posteriorly the shell is somewhat narrowed and the right valve bears a tongue-like porlongation, the edge of which bears sharp, recurved, teeth-like processes, but these are rather worn and inconspicuous in the specimen represented in the Musuem collection. The left valve is much deeper than the right and bears a terminal interior plate-like lamina, the nucleus of which is flattened and striated. There are two furrows on the surface of the valves. The valves are consequently divided into an anterior part ornamented with concentric ridges and imbricated radial ribs, and a posterior part traversed by concentric ridges with a single median imbricated radial groove which represents the posterior furrow. The area of the surface in front of the anterior furrow is only very faintly striated in both the valves. The edges of the left valve overlap those of the right when the shell is in the closed position. The shell is whitish throughout. Pamban.

Jouannetia cumingii (Sowerby).

Plate XXV, fig. 4.

Triomphalia cumingii, Sowerby, Proc. Zool. Soc. London, 1849, p. 161, pl. v, figs. 3, 3*a*.
Triomphalia cumingii, Sowerby, Thes. Conchyl., II, 1849, p. 502 ; pl. cv, figs. 56 and 57.
Jouannetia cumingii, Gray, Ann. & Mag. Nat. Hist., Ser. 2, VIII, 1851, p. 382.
Jouannetia cumingii, Fischer, P., Journ. de Conchyl., VII, 1858, p. 51.
Jouannetia cumingii, Chenu, Man. de Conchyl., II, 1862, p. 8, fig. 38.
Jouannetia cumingii, Tryon, Proc. Acad. Nat. Sci. Philadelphia, XIV, 1862, p. 216.
Pholas cumingii, Sowerby, in Reeve, Conch. Icon., XVIII, 1873, *Pholas*, pl. xi, fig. 43.
Jouannetia cumingii, Angas, Proc. Zool. Soc. London, 1877, p. 190.
Jouannetia cumingii, Dunker, Ind. Moll. Mar. Japonicum. 1882, p. 170.
Jouannetia cumingii, Hidalgo, Estud. Prelim. Fauna Malacol. Filip., 1903, p. 3.
Jouannetia cumingii, Hedley, Mar. Fauna Queensland Australas. Assoc. Adv. Sci., 1909, p. 351.
Jouannetia cumingii, Lamy, Journ. de Conchyl., LXIX, 1925, p. 217.
Jouannetia cumingii, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), I, No. 1, 1927, p. 108.

The shell of this species, with both valves together, forms an almost evenly spherical globe with a flat, triangular, plate-like appendage posteriorly, which is a prolongation of the

right valve. The left valve is considerably deeper than the right and its edge overlaps that of the latter, the two valves closing in tightly to form a compact spherical shell. Both the valves are traversed, somewhat posteriorly, by a vertical furrow, which is sharply bent above roughly at a right angle, the upper limb of this angle being slightly curved upwards and terminating far behind on the dorsal margin. The portion in fornt of this furrow is very faintly vertically striated in the right valve, but is practically smooth in the left. The part behind the furrow, however, is strongly concentrically ridged in both the valves. These ridges are crossed by a few distinct, oblique ridges at the angle of the furrow mentioned above. There is also another deep vertical groove very near the posterior margin along which the concentric ridges become bent at a sharp angle and directed from below upwards. They also become more raised and lamina-like in the region behind the groove. The pallial sinus is angular. The shell is pale brownish white throughtout. The animals are found in crevices of stones and coral rock. Pamban.

Genus **Pholadidea** (Goodall) Turton, 1819.

The shell is elongated, anterioly inflated, and its upper part is traversed by concentric undulating striae, while its lower part is indistinctly sculptured. The hind part of the shell is concentrically ridged, but not inflated. The anterior accessory plate is large only in the adult. The middle and posterior plates are rudimentary. Near the hind margin of each valve there is a horny process. The pallial line is almost entire.

Pholadidea sp.

Plate XXV, fig. 5.

A single specimen labelled '*Pholadidea sp.*, Krusadai Island, 1925' is represented in the Museum collection. The shell is small, ovoid, broad and inflated anteriorly, narrow and compressed behind. A horny, round-edged appendage is present at the posterior margin. As in *Martesia* there is a vertical furrow extending down from the umbo, but it is much fainter in the present specimen. The portion in front of the furrow is distinctly concentrically striated except for a small area bordering the antero-ventral margin, which is smooth. The two dorsal accessory plates are clearly distinguished. The portion behind the furrow is traversed by a few widely spaced concentric grooves. The specimen is apparently a young shell, and more material will have to be examined before its specific identity can be determined. Krusadai Island.

Sub-Order Anomalodesmata.

SERIES PANDORACEA.

Family LATERNULIDAE.

The shell is ovate, generally horny outside, and pearly, smooth and glossy on the inner surface. The hinge is entirely devoid of teeth. The nodule of the ligament is mounted on a projecting ledge from which an oblique internal ridge passes behind. The pallial sinus is well defined.

A single genus, *Laternula*, is represented at Pamban.

Genus **Laternula** (Bolten) Röding, 1798.

The shell is moderately elongated, thin, nearly or perfectly equivalve, inflated, gaping and usually produced into a broad beak posteriorly, rough on the outside, but smooth, pearly white and glossy inside. The ledge for the ligament nodule projects downwards and is supported by a thin, downwardly directed ridge. There is also a vertical thickening in front of, and parallel to it.

Two species, *L. anatina* and *L. corrugata*, have been recorded from Pamban. The former is readily distingusihed from the latter by the shell being more delicate and by its posterior portion being abruptly narrowed, spout-shaped and often markedly upwardly deflected, while in *L. corrugata* the shell is relatively thicker, more elongated and narrows down far more gradually towards the posterior margin.

Laternula anatina (Linné).

Plate XXV, figs. 6*a* and 6*b*.

Solen anatinus, Linné, Syst. Nat., Ed. X, 1758, p. 673 and Ed. XII, 1767, p. 1115.
Anatina subrostrata, Lamarck, Anim. sans vert., V, 1818, p. 463.
Anatina subrostrata, Hanley, Cat. Recent Bivalve Shells, 1843, p. 20.
Anatina subrostrata, Catlow & Reeve, Conch. Nomencl., 1845, p. 8.
Anatina subrostrata, Gray, Proc. Zool. Soc. London, 1847, p. 190.
Anatina subrostrata, Adams, H. & A., Genera of Recent Mollusca, II. 1856, p. 361.
Anatina subrostrata, Chenu, Man. de Conchyl., 1862, p. 37, p. 36, figs. 156 to 160.
Anatina subrostrata, Reeve, Conch. Icon., XIV, 1863, *Anatina*, pl. i, fig. 6.
Anatina subrostrata, Vaillant, Journ. de Conchyl., XIII, 1865, p. 121.
Anatina subrostrata, Mac Andrew, Ann. & Mag. Nat. Hist. Ser. 4, VI, 1870, p. 445.
Anatina siphonata, Smith, "Challenger", Zoology, XIII, 1885, Lamellibranchiata, p. 76.
Anatina subrostrata, Cooke, Ann. & Mag. Nat. Hist., Ser. 5, XVIII, 1886, p. 100.
Anatina subrostrata, Shopland, Proc. Malacol. Soc. London, V, 1902, p. 177.
Anatina subrostrata, Melvill & Standen, Proc. Zool. Soc. London, 1906, p. 845.
Anatina anatina, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 191.
Laternula anatina, Prashad, Siboga-Expeditie, Pelecypoda, Monogr. CXVIII, 1932, p. 319.
Laternula anatina, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 66.

This species has been better known as *Anatina subrostrata* to earlier authors, but its synonymy with the original Linnaean species, *Solen anatina* has now been definitely established. Reeve's species, *Anatina bullata, A. siphonata, A. flexuousa, A. Blainvillei, A. labiata, A. amphora* and *A. exima* are all synonymous with the present species. This species is widely distributed in the Indo-Pacific Region and has been recorded also from the Madras area. The shell is very thin, delicate, and of an oblong-ovoid shape. The anterior margin is broad and rounded, and the lower margin evenly curved up to very near the posterior margin where it gets abruptly indented and inclined upwards, reducing the extreme posterior part of the shell to a narrow, upwardly turned spout-shaped beak with a rounded and gaping margin. The surface of the shell is faintly concentrically striated, and for the most part minutely granulated, especially towards the margins. Remnants of a horny periostracum can be made out on the surface. The ledge for the ligament nodule, the thin lamina beneath it and the pallial sinus are typically developed as mentioned in the description of the genus. The inner surface is glossy and bears a silvery iridescence. Pamban.

Laternula corrugata (Reeve).

Plate XXV, figs. 7*a* and 7*b*.

Anatina corrugata, Reeve, Conch. Icon., XVI, 1863, *Anatina*, pl. iv, fig. 25.
Anatina corrugata, Sowerby, Thes. Conchyl., V, 1887, pl. 470, fig. 19.

The shell is relatively thicker, less fragile and more elongate than that of the preceding species. The anterior margin is broad and bluntly rounded, and the lower margin gradually curves up as it approaches the posterior end. The width of the shell thus gets gradually narrowed down considerably towards the hind margin which is narrow and obliquely truncated, but does not form a well defined spout-like projection as in the preceding species. The surface of the shell is faintly concentrically striated, these striae being stronger and more pronounced over the extreme posterior part of the surface. The anterior part of the shell is more markedly inflated than the posterior. The inner surface is smooth, but not as glossy and pearly white as in the preceding species. The characters of the ligamentary ledge, ridge and pallial sinus are the same as in *L. anatina*. A few empty shells of this species are represented in Mr. Crichton's collections. Pamban.

SERIES CLAVAGELLACEA.

Family CLAVAGELLIDAE.

This family includes the peculiar group of bivalve shells popularly known as the pepper-pot or watering-pot shells owing to their characteristic shape and appearance. The bivalve shell itself is very small and inconspicuous, and one or both are continued backwards into a calcareous tube secreted by the siphons. The anterior end of this tube is often closed

by a perforated, sieve-like plate and surrounded by a number of fine, close-set tubes. The pallial line is sinuous and the foot small and without a byssus.

This family includes two genera, *Clavagella* and *Brechites* (= *Aspergillum*), of which the latter alone is represented at Madras and Pamban.

Genus **Brechites** Guettard, 1770.

(Syn. **Aspergillum** Lamarck, 1818).

The shell is very small, almost equivalve, with fine, radial striae and lying upon an elongated tube with a perforated anterior end which is often fringed with a row of fine tubuli all round. The hind end of the tube is very narrow. The siphons are very long, but the foot is rudimentary.

Only a single species, *Brechites dichotomus*, which is also the sole representative of the genus in the Madras area, has been recorded from Pamban and is represented in the Museum collection by a single entire specimen from Pamban.

Brechites dichotomus (Chenu).

Plate XXV, figs. 8*a* and 8*b*.

Aspergillum dichotomum, Chenu, Illustr. Conch., 1843-45, *Aspergillum*, p. 3, pl. ii, fig. 6.
Aspergillum dichotomum, Catlow & Reeve, Conch. Nomencl., 1845, p. 1.
Brechites dichotomus, Adams, H. & A., Genera of Recent Mollusca, II, 1858, p. 339.
Aspergillum dichotomum, Reeve, Conch. Icon., XII, 1860, *Aspergillum*, pl. iii, fig. 9.
Penicillus dichotoma, Tryon, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 59, No. 2.
Aspergillum dichotomum, Clessin, in Martini-Chemnitz., Conch. Cab., XI, 4 Abth., A. 1894, p. 30 No. 9, pl. xii, fig. 2.
Brechites dichotomus, Lynge, Marine Lamellibranchiata of the Danish Expedition to Siam, 1909, p. 192.
Brechites dichotomus, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 197.
Brechites dichotomus, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 66.

The shell itself is comparatively minute, and attached in a gaping position to the large calcareous tube, the place of attachment being slightly depressed. The perforations at the anterior extremity are each surrounded by a slight elevation of their margins and this gives the convex disc on which they occur the appearance of the lid of a pepper pot or watering can, hence the popular name watering or pepper-pot shell. The fine tubuli round the periphery are closely arranged and are sometimes simple, but very often bifid distally. The depressed area on which the minute shell is mounted is finely concentrically striated. The mounted specimen of this species exhibited in the shell gallery of the Museum had been collected from Pamban.

Class CEPHALOPODA.

The Cephalopoda are divided into two main groups, namely, (1) the Tetrabranchiata, characterised by two pairs of gills and a lobed foot bearing tentacles and including the

genus *Nautilus* and (2) the Dibranchiata, with only a single pair of gills and the foot modified into ten or eight arms bearing suckers, and including the remaining genera of the Cephalopoda. Of these two sub-classes, the Dibranchiata alone is represented at Krusadai. It includes the octopuses, squids and cuttlefishes.

Sub-Class **DIBRANCHIATA.**

The families represented at Krusadai may be distinguished with the aid of the following key :—

1. Shell absent or rudimentary (but present in *Argonauta*, the paper Nautilus, which is not represented at Krusadai, and in which it is secreted by the oral arms and hence not homologous with the other shells). Only eight arms present, all similar and longer than the body. Suckers simple and sessile. Nidamentary glands absent. Body more or less short and saccular	OCTOPODIDAE, p. 183. (Order OCTOPODA), p. 183.
2. Shell present, but frequently more or less internal, occasionally partly external. Shell either simply chitinous, or more often calcified. Eight normal arms, shorter than the body, are present, but one pair of long tentacular arms developed in addition to the eight normal ones. Suckers pedunculated and provided with horny rings. Nidamentary glands present	2 (Order DECAPODA), p. 176.
— Shell generally small, tubular, coiled, multilocular and siphunculated, partly external, the dorsal and ventral aspects of the aboral extremity of the shell being exposed and left uncovered by the mantle. Living specimens rare, bottom-living ..	SPIRULIDAE, p. 176.
— Shell not coiled, but flattened and elongated and generally with a short spine, the rostrum, at the hind end. Shell completely internal. Living specimens much commoner and almost always littoral in habit	3

3. Body of the animal wide, flattened and ovate. Fins narrow, inconspicuous and extending the entire length of the body but not projecting beyond its limit. Shell calcareous, thick, but flattened, elongated, laminated and of a more or less porous and brittle consistency and generally washed up on the beach in large numbers (the cuttlebone) ..	SEPIIDAE, p. 177.
— Body elongated, narrow and conical or more or less cylindrical. Fins large, prominent, triangular or rounded and distinctly extending beyond the aboral half of the body, but sometimes extending over the whole length of the body. The shell is a well developed chitinous blade (the gladius), but too delicate to survive being washed up on the beach	LOLIGINIDAE, p. 180.

Order Decapoda.

SERIES SEPIACEA.

Tribe OIGOPSIDA.

Family SPIRULIDAE.

The arms carry suckers. The shell is situated at the posterior extremity of the body. It is spirally coiled, with loosely wound whorls, but without the rostrum and the horny lamina. The last chamber is shallow and bears a simple margin. The siphon is internal and ventral.

This family includes a single genus, *Spirula*, represented by only three living species.

Genus **Spirula** Lamarck, 1790.

With the characters of the family.

The Pamban specimens of this genus have been identified as *Spirula spirula* Linné, though there has been some uncertainty with regard to the exact nomenclature of this species. Mr. Winckworth, in his notes on this species, comments that "the difficulty here is that there are two species whose shells are so close that they cannot be distinguished. In the circumstances it seems reasonable to refer to the shells as *Spirula spirula* (Linné).

Spirula prototypos and its synonyms *S. australis* and *S. peronii* refer to the same specimen and is the first animal taken, but I don't think it is necessary to emphasise this, except in critical work."

Spirula spirula (Linné).

Plate XXVI, figs. 1*a* and 1*b*.

Nautilus spirula, Linné, Syst. Nat., Ed. X, 1758, p. 710.
Spirula fragilis, Lamarck, Systeme, 1801, p. 102.
Spirula prototypos, Peron & Lesueur, Voy. terres. Australas. Atlas, I, 1807, pl. 30.
Spirula australis, Lamarck, Encyclopédié Methodique, Vers. 1816, pl. 465, Liste 13.
Spirula peronii, Lamarck, Anim. sans vert., VII, 1822, p. 601.
Spirula peronii, Hornell, Common Molluscs of South India, Mad. Fish. Bull., XIV, 1921, p. 208.
Spirula prototypos, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 68.

A few worn shells from the Pamban Coast and a single fairly fresh shell washed up on the beach on Krusadai Island are represented in the Museum collection. The shell is tubular and coiled spirally, the tube getting gradually wider from the centre of the coil towards the periphery. It is rather fragile, with a smooth surface which displays a pearly iridescence. The shell is divided into a series of chambers by septa with their concave surfaces facing away from the narrower extremity of the shell. The septa are pierced by a small circular aperture placed centrally on their ventral margin. Through this aperture the siphon—a hollow strand of living tissue—passes in the living animal. The surface of the septum is smooth and pearly. The positions of the septa are indicated on the external surface of the shell by opaque whitish or pale yellowish rings at which the surface is slightly depressed, thus rendering the interseptal regions of the shell wall slightly convex. The shell is translucent whitish throughout, except for the opaque white bands mentioned above. In the Krusadai shell contained in the Museum collection twenty-two chambers can be counted. The diameters of the shell at the narrowest and broadest parts are 1·5 mm. and 6 mm. respectively. The maximum width of the entire spiral is 20 mm. The characteristic shape and appearance of the shell have been partly responsible for its pupular name, "the ram's horn shell." The living animal is rare and has not been taken either at Madras or at Pamban. The position of the shell in relation to the soft parts of the animal, however, is shown in figure 295 on page 337 of Lankester's volume on Mollusca, in his Treatise on Zoology. Pamban and Krusadai Island.

Tribe MYOPSIDA.

Family SEPIIDAE.

The body is broad, ovate, more or less flattened and bordered on each side by a narrow fin along its entire length. The sessile arms bear pedunculated suckers. The tentacular arms are completely retractile. The shell is internal, rendered solid by calcareous deposits disposed in the form of close-set laminae and bearing a sort of hollow space or pocket behind, on the ventral side.

Two genera, *Sepia* and *Sepiella* are represented at Pamban. The latter may at once be distinguished from the former by the absence of any rostrum to the shell. Consequently the posterior end of the body is smooth and rounded in *Sepiella* without the small spike between the fins as in *Sepia*.

Genus **Sepiella** Gray, 1849.

The shell is devoid of a rostrum, narrowly ovate in outline and with the horny margin forming a thin broad plate behind the calcareous portion. The pocket is rudimentary.

A single species, *Sepiella inermis*, also represented at Madras, has been recorded from the Pamban area.

Sepiella inermis (Férussac et d'Orbigny).

Plate XXVI, figs. *2a* and *2b*.

Sepia inermis, Férussac etd' Orbigny, Hist. Nat. Gen. et part. Céph. acétab., 1835—1848, p. 226, pls. 6 and 20.

Sepiella inermis, Goodrich, Trans. Linn. Soc. London, 2, VII, 1896, p. 5.

Sepiella inermis, Hoyle, in Stanley Gardiner's Fauna and Geography of the Maldive and Laccadive Archipelagoes, II, Supl. I, Cephalopoda, 1905, p. 982, fig. 152 (hectocotylus).

Sepiella inermis, Massy, Rec. Ind. Mus., XII, 1916, No. 4, p. 231.

Sepiella inermis, Winckworth, Spolia Zeylanica, XIII, Pt. 3, 1926, p. 330.

Sepiella inermis, Adam, Siboga-Expeditie, Cephalopoda, Pt. 2, Monogr. LV b, 1939, pp. 94 to 98 and 104 and 105; text figs. 1–5; pl. iv, figs. 5–6; pls. vi–vii.

Sepiella inermis, Gravely, Bull. Mad. Govt. Mus. (Nat. Hist.), V, No. 1, 1941, p. 69, fig. 25c.

This species is widely distributed in the Indian Ocean. Judging from the large number of cuttlebones of this species washed ashore on Krusadai Island and the neighbouring areas, this species seems quite common and appears to be well represented in the Pamban area, but so far only the shells have been collected from this locality. The shell is moderately small and rather narrowly ovate in outline. The pocket on the ventral side at the posterior extremity of the calcareous part is rudimentary and is bounded by widely arched, highly polished, yellowish white horns. The horny margin forms a characteristic, thin, broad plate behind the calcareous portion and is highly glossy. The rostrum is absent. The calcareous part of the shell is markedly thickened in the middle and thins down considerably towards the extremeties. The posterior half of the ventral surface of the calcareous portion bears a well marked median groove and is finely concentrically striated, while the anterior half is smooth and devoid of any distinct median groove, except for a shallow median depression towards the anterior end. The dorsal surface is finely granular and bears two shallow longitudinal grooves which gradually diverge from the posterior to the anterior extremity, and enclose between them a slight, broadly rounded elevation. The shell is chalky white, but the horny margin is pale brown and polished. The largest of the shells collected from the Pamban area measures about 65 mm. in length, 30 mm. in width and 11 mm. in thickness at the middle part where it is thickest. Krusadai Island and Pamban.

Genus **Sepia** Lamarck, 1798.

The shell is elongated, terminated behind by a more or less well developed rostrum, and placed under the integument of the dorsal surface of the animal. The mantle sac is without glandular pores.

Two species, *S. rouxii* and *S. aculeata*, have been recorded from the Pamban area, but unfortunately both the species are represented in the Museum collection only by their shells or cuttlebones. They are also recorded from Madras. In *S. rouxii* the shell attains a very large size and the horny crest at the posterior end is large rendering the pocket very deep, but at the same time greatly dorso-ventrally compressed, while in the latter the horny crest is relatively less extensive, the pocket being consequently shallow and widely open.

Sepia rouxii Férussac et d'Orbigny.

Plate XXVI, fig. 3.

Sepia rouxii, Férussac et d'Orbigny, Hist. Nat. Gen. et part. Céph. acétab., 1835-1848, p. 271, pl. 19.
Sepia rouxii, Gray, Cat. Moll. Brit. Mus., I, 1849, Cephal. antep., p. 100.
Acanthosepion rouxii, Rochebrune, Bull. Soc. Phil. Paris (7), VIII, 1884, p. 108.
Sepia rouxii, Hoyle, Rep. Pearl Oyster Fish. Gulf of Manaar, Suppl., XIV, 1904, p. 198.
Sepia rouxii, Winckworth, Proc. Malacol. Soc. London, XXII, 1936, p. 16.
Sepia rouxii, Adam, Siboga-Expeditie, Cephalopoda, Pt. 2, Monogr. LV b, 1939, pp. 56-61, pl. i, fig. 4 and pl. ii, figs. 6 and 7.

Several large cuttlebones of this species from Shingle Island are represented in the Museum collection. The thickened calcareous portion of the shell bears a well defined, but broad and shallow median groove along the ventral surface which extends forwards from near the posterior extremity for about three-fourths of the length of the shell. The calcareous part is thickest at about the point where the furrow terminates in front, but it is widest at about the level of the middle of the shell. The horny crest is very large and extensive, enclosing a deep but much flattened pocket between itself and the shell. The rostrum is well developed and curved upwards. The dorsal surface is coarsely granular and bears three rather indistinct longitudinal ridges narrowly diverging from the posterior extremity. The largest specimen in the collection measures just over a foot in length and about four inches across at its widest part. Shingle Island.

Sepia aculeata Férussac et d'Orbigny.

Plate XXVI, fig. 4.

Sepia aculeata, van Hasselt MS., *Férussac et* d'Orbigny, Hist. Nat. Gen. et part. Céph. acétab., 1835-1848, p. 287, pls. 5 bis, 25.
Sepia aculeata, Gray, Cat. Moll. Brit. Mus., I, Cephal. antep., 1849, p. 105.
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Sepia aculeata, Hoyle, "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 22.
Sepia aculeata, Sasaki, Monogr. Dibr. Cephal. Japanese and adjacent waters, 1929, p. 171.
Sepia aculeata, Winckworth, Spolia Zeylanica, XIII, Pt. 3, 1926, p. 330.
Sepia aculeata, Adam, Siboga-Expeditie, Cephalopoda, Pt. 2, Monogr. LV b, 1939, pp. 70–72, pl. ii, figs. 1 to 5.

This species is also represented in the Museum collection only by cuttlebones from the Pamban area. The shell is broadly elliptical in outline, and though broadest near the middle, the widest part of the thickened calcareous portion lies well in front of the middle. The anterior end is bluntly angular and the thin horny border of the shell is very wide especially at the posterior part. The chitinous margin is continuous under the rostrum. The dorsal surface is convex and bears three longitudinal ridges, as in the preceding species, but more broadly diverging. It is also thickly overlaid with calcareous deposit and is coarsely rugose. The ventral surface of the thickened calcareous portion is slightly and evenly convex, without any median groove. The inner horny crest is very well developed, arising from about the level of one-third of the length of the shell from the posterior end. It is at first thin and lies flat on the outer cone (i.e., the broad, marginal blade), but becomes thicker and raised posteriorly, forming a broad, stout border for the posterior hollow pocket of the shell. The anterior edge of this crest is sharp. The rostrum is fairly long, stout and glossy. Shells of various sizes have been collected. The largest specimen in the collection measures 180 mm. long and 60 mm. broad at its widest part. Pamban, Krusadai and Shingle Islands.

SERIES LOLIGINACEA.

Family LOLIGINIDAE.

The body is elongated, more or less tapering posteriorly. The fins are terminal, triangular or rounded and are about half as long as the body or even a little longer and extending further forwards than the aboral half of the body, but sometimes large, ovate and marginal. The gladius is well developed as a long chitinous blade, pointed in front.

Two genera, *Loligo* and *Sepioteuthis* are represented at Pamban, each by a single species. In the former, the fins are rhomboidal, a little longer than half the length of the mantle, while in the latter the fins are ovate, large and extending the entire length of the mantle.

Genus **Loligo** Lamarck, 1798.

The body is elongated and narrowed posteriorly. The mantle is moderately thin. The fins are rhomboidal and terminal, and extending a little beyond half the length of the body. The nidamental glands are strongly developed.

Loligo indica Pfeffer.

Plate XXVII.

Loligo indica, Pfeffer. Ceph. Hamb. Mus., 1884, p. 4, figs. 3 and 3*a*.
Loligo indica, Hoyle, "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 156, pl. xxvi.
Loligo indica, Goodrich, Trans. Linn. Soc. London, 2, VII, 1896, p. 7, pl. ii, figs. 20 to 28.
Loligo indica, Massy, Rec. Ind. Mus., XII, 1916, No. 4, p. 218, pl. xxiii and pl. xxi, fig. 10.
Loligo indica, Winckworth, Spolia Zeylanica, XIII, Pt. 3, 1926, p. 329.

Only a single Pamban specimen is contained in the Museum collection, but the species is well represented in the Indian waters. The body is conical, narrow and elongated, tapering to a blunt point posteriorly. The fins taken together, are broadly rhomboidal and extend to just a little in front of half the length of the mantle. The posterior end of the body grows at a faster rate than the rest of the body so that in full-grown sepecimens the fins attain a considerably greater proportion. The ventral surface of the mantle bears a thin, median longitudinal ridge. The anterior margin of the mantle is furnished with a well marked, bluntly angular projection on the mid-dorsal line and on the ventral side, the anterior margin of the mantle is broadly excavated. The head is slightly narrower than the body, and is relatively short, being about one-sixth of the length of the mantle. The funnel on the ventral side is typical. The arms are unequal, differing in length slightly, the order of the arms according to their respective lengths being 3, 4, 2, 1. They are markedly triangular in cross section, the second, third and fourth having distinct, web-like keel on their outer angular margins. The arms bear well developed rounded suckers in two rows. They are sub-globular and mounted on short peduncles. The suckers bear horny rings which, in the males, are armed with about 9–11 rounded teeth. The tentacular arms are long and slender, with the distal, slightly dilated 'club' occupying about one-fourth of its entire length. The club bears well developed suckers arranged in four rows, but distally the suckers become very small. There are about 21 teeth in the horny ring of these tentacular suckers. The lobes of the buccal membrane are provided with small, toothed suckers. The gladius is narrow, elongately elliptical and pointed at both ends. The surface of the animal is smooth throughout. The colour of the preserved specimen is brownish, but the mantle and head are somewhat darker than the fins and arms which are slightly more yellowish and paler. Purplish chromatophores are seen scattered all over the back of the head and mantle, those on the head being larger. The measurements of the single spirit-preserved female specimen in the collection are as follows: length of the mantle (upper surface), 81 mm.; breadth of the mantle (at the commencement of the fins), 20 mm.; breadth of the fins (together), 46 mm. The hectocotylus is of course absent, as the specimen is a female. **Pamban.**

Genus **Sepioteuthis** Blainville, 1824.

The body is conico-cylindrical, ending rather bluntly behind. The fins are large, extending the entire length of the mantle in the adult, and together, having an ovate outline.

The dorsal anterior mantle edge is obtuse-angled. The shell has curved lateral margins.

Sepioteuthis arctipinnis Gould.

Plate XXVIII.

Sepioteuthis arctipinnis, Gould. U.S. Exploring Exp., Mollusca, XII. 1852, p. 479, pl. 49.
Sepioteuthis arctipinnis, Hoyle. "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 28.
Sepioteuthis indica, Goodrich, Trans. Linn. Soc. London. 2. VII. 1896, p. 5, pl. vii. figs. 9 to 13,
Sepioteuthis arctipinnis, Berry, Proc. United States Nat. Mus., XXXVII, 1909, p. 418.
Sepioteuthis arctipinnis, Massy, Rec. Ind. Mus., XII, 1916, p. 237.
Sepioteuthis arctipinnis, Winckworth, Spolia Zeylanica, XIII, 1926, p. 331.
Sepioteuthis arctipinnis, Adam, Siboga-Expeditie, Cephalopoda, Pt. 1. Monogr. LV b, 1939, p. 13.

Two specimens, a male and a female, collected at Rameswaram are represented in the collection. The animal is elongately conical, tapering behind into a blunt extremity, but the anterior half of the mantle is almost cylindrical. The fins are large, extending throughout the length of the mantle and joining each other at the hind end; their surface is very finely transversely striated throughout. The head is moderately elongated and bears two prominent undulating olfactory folds below the eyes. The arms are strong and provided on both sides with a lateral membrane. The suckers are closely set and arranged in two rows. The horny ring is armed with from 20 to 28 strong teeth. The tentacular arms are thick, and somewhat flattened towards the base. The club is broad and elongated and bears suckers in four rows, the proximal and distal suckers being much smaller than the central ones. The club bears a strong keel along its outer surface and a marginal membrane on each side. At the tip of the club there is a special, depressed, spoon-shaped structure bearing very small, highly specialised suckers arranged in two rows on either side separated by a central space. This apical set is characteristic of the present species, but is developed to a less extent also in the preceding species. The horny rings of the tentacular suckers bear from 15 to 17 teeth. The buccal membrane is large and bears seven lobes bearing very small suckers. The gladius is somewhat broader than in *Loligo indica*, lanceolate and convex above, with a strong, raised ridge along the middle. The preserved specimens are pale yellowish brown, stippled all over with purplish chromatophores, but far more profusely on the dorsal surface of the mantle, head and arms than on the ventral surface. The female specimen is slightly larger than the male but neither of them is fully mature and the male has not yet developed the hectocotylised arm. The measurements of the specimens are as follows :—

	Male. MILLIMETRE.	Female. MILLIMETRE.
Length of upper surface of mantle	126	136
Breadth of the mantle at the middle	39	45
Maximum breadth of each fin	15	20

Rameswaram.

Order Octopoda.

Sub-Order Incirrata.

SERIES OCTOPODACEA.

Family OCTOPODIDAE.

This family includes small to gigantic octopods of more or less fleshy consistency. The body is rounded and compact and the mantle is without fins. As a rule an ink sac is present. The ctenidium bears both internal and external lamellae. The basal parts of the arms are connected by an extensive membranous umbrella.

Two genera, *Octopus* and *Cistopus* are represented at Pamban. In the former, velar pouches are absent, but the hectocotylus is well defined, though short, while in the latter the velar interspaces are occupied by a series of pouches embedded in the webs and opening on the oral surface of each interspace and the hectocotylus is undifferentiated.

Genus **Octopus** Lamarck, 1798.

[Syn. **Polypus** (Schneider, 1784) Hoyle, 1901].

The arms bear a moderately broad, as a rule bilaterally symmetrical web. The third right arm is hectocotylised. The mantle opening is wide. The penial diverticle is single. Velar pouches are absent.

Two species, *O. honkongensis* and *O. rugosus*, have been recorded from Pamban. In the former the web is almost perfectly radially symmetrical, the surface beset with stronger wrinkles and tubercles and there are two cirri over each eye, while in the latter, the web is more strictly bilaterally symmetrical, the sector (A) immediately in front of the interocular region being deeply incised, the wrinkles and tubercles on the surface are much weaker, and there are no cirri over the eyes.

Octopus honkongensis Hoyle.

Plate XXIX, fig. 1.

Octopus honkongensis, Hoyle, Ann. & Mag. Nat. Hist., (5), XV, 1885, p. 224.
Octopus punctatus, Grabb, in Hoyle, "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 100.
Octopus punctatus, Ortmann, Zool. Jahrb. Jena, III, 1888, p. 662.
Polypus honkongensis, Berry, Bull. United States Bur. Fisheries, Washington, XXXI, 1914, p. 280.
Polypus honkongensis, Massy, Rec. Ind. Mus., XII, 1916, p. 185.
Octopus honkongensis, Winckworth, Spolia Zeylanica, XIII, Pt. 3, 1926, p. 326.
Paroctopus honkongensis, Robson, A Monograph of the Recent Cephalopoda, I, 1929, p. 120.

Several specimens of this species have been collected on Krusadai Island. The body is rather short and globular, the mantle being about as broad as long. The head is considerably narrower than the body and is marked off by lateral constrictions. The arms are

powerful and more or less quadrangular in cross-section. On the left side the order of the arms according to their lengths is 1, 2, 3, 4, while on the right it is 2, 1, 4, 3. The suckers are biserial and rather closely, but alternately arranged. They are sometimes contracted in preserved specimens and appear triangular in outline. The suckers become successively larger from the mouth and are somewhat abruptly enlarged at the 5th-6th pair where they reach their maximum size and whence they gradually decrease in size towards the tip of the arms. The web is well developed and extends up to about one-fourth the length of the arms. The surface is covered with numerous, rather small, pointed tubercles and short, irregular transverse wrinkles, and there are two stiff cirri above each eye borne on a characteristic prominence. The mantle aperture is moderately wide. The specimens in the collection are rather badly discoloured, being of a pale greyish brown, but one of them is dark purplish brown throughout. The lower surface of the arms and mantle are distinctly paler than the upper. The surface is minutely stippled throughout with reddish brown chromatophores. One of the specimens, in which two of the arms are broken off, has regenerated a fine, short, finger-like process bearing small suckers on the broken stumps. The hectocotylus is not present in any of the specimens as they are all female. The specimens represented in the Museum collection are rather young. A few of these have been collected from beneath the Pamban bridge. This is the common littoral Octopus of Krusadai Island, and may be found swimming actively in the shallow water regions at low tide after dusk. The eggs are small, ovate and laid in clusters attached to weeds or shells. Krusadai Island.

Octopus rugosus (Bosc).

Plate XXIX, fig. 2.

Sepia rugosa, Bosc, Actes Soc. Hist. Nat. Paris, 1792, 1, p. 24, tab. 5, figs. 1 and 2.
Octopus granulatus, Lamarck, Bull. Soc. Phil. Paris, II, 1798, p. 130.
Octopus rugosus, Férussac et d'Orbigny, Hist. Nat. des Céphal. acétab., 1840, p. 45, pl. 6, 23.
Octopus boscii, Lesueur, var. *pallida*, Hoyle, "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 81, pl. i.
Polypus granulatus, Hoyle, in Herdman's Rep. Pearl Oyster Fisheries of the Gulf of Manaar, II, 1904, p. 105.
Polypus rugosus, Massy, Rec. Ind. Mus., XII, 1916, p. 189.
Polypus granulatus, Massy, Ann. Natal Mus., P' M' burg, V, 1925, p. 222.
Octopus rugosus, Winckworth, Spolia Zeylanica, XIII, Pt. 3, 1926, p. 324.
Octopus (Octopus) rugosus, Robson, A Monograph of the Recent Cephalopoda, I. 1929, p. 63, pl. ii, fig. 3.

This species is very widely distributed, occuring in all warm seas, and is represented in the collection by two specimens from Rameswaram and one from Krusadai Island. The body is more or less saccular, but is distinctly more elongated in proportion to its width than in the preceding species, the width being only about three-fourths the length. The arms are somewhat shorter than in *O. honkongensis*. The suckers are biserial, closely set and alternately arranged. The largest suckers are found on the second arm and occur at about the sixth pair. The order of the arms according to their lengths is usually 2, 3, 4, 1. The web is bilaterally symmetrical and the sector immediately in front of the interocular space

(i.e., sector A) is deeply incised. The aperture of the mantle is wide and the funnel is well developed. The surface is covered with close-set granules and small warts which are usually well developed on the inside of the web. The preserved specimens are dirty greyish brown, but paler on the ventral side. The surface is very minutely stippled with purplish chromatophores. Like the preceding species, it is a shallow water form and is found in the littoral zone, on coral reefs and among rocks. The characters of this species are subject to considerable variation. **Rameswaram and Krusadai Island.**

Genus **Cistopus** Gray, 1849.

The velar interspaces are occupied by a series of pouches embedded in the web and opening on the oral surface of each interspace. The hectocotylus is not differentiated.

This genus includes a single species, *Cistopus indicus* of which *C. bursarius* mentioned in the previous list of Krusadai Mollusca (*Bull. Mad. Govt. Mus. Nat. Hist.*, I, No. 1, 1927, p. 109), is a synonym.

Cistopus indicus (Férussac et d'Orbigny).

Plate XXX.

Octopus indicus, Férussac et d'Orbigny, Hist. Nat. des Céphal. acétab., I, 1840, p. 24, pl. xxvi.
Cistopus indicus, Gray, Cat. Moll. Brit. Mus., Pt. 1, 1849, p. 20.
Cistopus indicus, Tryon, Man. Conch., I, 1879, p. 127.
Cistopus indicus, Murtens, Ubersicht der in Moss. gesam. Moll., M.B., A.K., 1880, p. 727.
Cistopus bursarius, Steenstrup MS. in Hoyle, "Challenger", Zoology, XVI, 1886, Cephalopoda, p. 14.
Cistopus indicus, Robson, A Monograph of the Recent Cephalopoda, I, 1929, p. 182.

A single female specimen from Krusadai Island is represented in the collection. The visceral sac is broad and saccular, but in the male it is long and narrow. The ventral surfaces and sides are smooth but the dorsum is covered with a few, feebly developed and widely spaced warts. The arms are in the order 1, 2, 4, 3 with respect to their lengths. The suckers are very prominent and raised, diagonally arranged and almost linear; they are also less closely set than in the preceding species. The web is somewhat shallow and extends only very slightly up the sides of the arms. On the oral side the velar interspaces contain a series of elongately ovoid pouches opening on the oral surface of each interspace by a subterminal pore, and thus having a characteristic, star-shaped arrangement. They are situated between the bases of the arms and are separated from each other by a single row of suckers. Each pouch measures about 5 mm. long. The exact function of these pouches is not clearly known. The ink sac bears a long and slender duct. The funnel

is broad and prominent. The interocular space is considerably reduced. The preserved specimen contained in the Museum collection is dull purplish grey on the dorsal surface, but very pale, yellowish grey ventrally. The minute, purplish chromatophores are confined to the dorsal surface of the mantle and the sides and dorsal surface of the arms. The specimen is rather young, the head and visceral sac (excluding the arms) measuring only about 30 mm. long, but adults attain a much larger size. Krusadai Island.

REFERENCES TO LITERATURE FOR SCAPHOPODA, PELECYPODA AND CEPHALOPODA.

Note.—The following list includes most of the better known standard works on the subject as well as a selection of some of the more important papers published in various periodicals, and referred to in the present volume. For other references, the reader is referred to the lists of references prefixed to the descriptions of the various species recorded in this paper.

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INDEX

Names of genera and species (whether accepted or mentioned as synonyms) are printed in Roman type, as are also names of families, orders, etc. Popular names are printed in italics.

PAGES

A

abbreviata (Gafrarium dispar, var.) 110
aculeata (Sepia) 179, 180
aculeatum (Acanthosepion) 180
Adapedonta 11, 157
Adesmacea 168
adusta (Pinna) 56
aegyptiaca (Lutraria) 142
aegyptiaca (Mactra) 142
aegyptiaca [Mactra (Standella)] 142
aegyptiaca (Merope) 142
aegyptiaca (Spisula) 142
aegyptiaca (Standella) 142
aegyptiaca [Standella (Merope)] 142
aequilatera (Pinna) 55
aequivoca (Circe) 110
aerata (Avicula) 52
ala (Tellina) 153, 154, 155
alabastrum (Dione) 113
alabastrum (Pitar) 112, 113
Ala-papiliones (Paphia) 130
ala-papiliones (Paphia) 129, 130, 131
ala-papiliones [Paphia (Paphia)] 130
albida (Mactra cuneata, var.) 139
albus (Malleus) 48
Aloides 160
Aloididae 15, 160
alta (Venus) 125
Amphidesma 150
Amphineura 1, 189
amphora (Anatina) 173
anatina (Laternula) 172, 173
anatina (Solen) 173
anatinus (Solen) 172
angela (Codakia) 79, 80
angela [Lucina (Codakia)] 79
angulata (Tellina) 153, 154, 155
angulatum (Gafrarium) 108
Anisomyaria 6, 7, 8, 29
Anisomyarian 29

PAGES

Anomalodesmata 11, 172
Anomia 65
Anomiacea 65
Anomiidae 10, 65
anomioides (Avicula) 53
anomioides [Avicula (Meleagrina)] 53
anomioides (Margaritifera) 53
anomioides (Pinctada) 51, 52, 53
Antigona 100, 104, 122, 123
Antillarum (Lithodomus) 40
antillarum (Lithodomus) 40
antillarum (Lithophaga) 40
Antillarum (Lithophagus) 40
antillarum [Modiola (Lithophagus)] 40
antiquata (Cardita) 71
antiquata (Mactra) 140
antiquata (Venericardia) 71
antiquatus (Actinobolus) 71
aperittus (Donax) 145, 150
apertissima (Gastrochaena) 163, 164, 165
apertissima (Rocellaria) 164
aprinum (Dentalium) 3, 4
arakana (Cryptogramma) 121
arakana (Venus) 120, 121, 122
Arca 17, 19, 23, 25, 93
Arcacea 17
Arcidae 8, 17
arctipinnis (Sepioteuthis) 182
arenata (Modiola) 41
Argonauta 175
ark shells 17
asiaticum (Cardium) 90, 92
Asiaticum [Cardium (Bucardium)] 92
asper (Euchelus) 20
Aspergillum 174
aspersa (Tapes) 131, 132
aspersus (Solen) 158, 159
assimile (Cardium) 91, 94

PAGES
Astartacea .. 70
Atrina .. 54, 56
atropurpurea (Pinna) .. 54, 55
augustana (Pinna) .. 54
australe (Cardium) .. 90, 94
australe [Cardium (Bucardium)] .. 94
australe [Cardium (Laevicardium)] .. 94
Australis (Donax) .. 145
australis (Plicatula) .. 58
australis (Spirula) .. 177
australis (Venus) .. 116
avellana (Arca) .. 19, 20, 23
avellana [Arca (Navicula)] .. 20

B

barbata (Avicula) .. 51
Beguina .. 71, 72
Belcheri (Limopsis) .. 28
belcheri (Limopsis) .. 28
belcheri (Pectunculus) .. 28
bella (Lucina) .. 80
bicolor (Cardita) .. 71, 73
bicolor (Donax) .. 145, 146
bicolor (Pinna) .. 54, 55
bicolor (Venericardia) .. 71
bicolor [Venericardia (Cardites)] .. 71
bilocularis [Brachidontes (Septifer)] .. 35
bilocularis [Barchyodontes (Septifer)]. 35
bilocularis (Mytilus) .. 35
bilocularis (Septifer) .. 35
bilocularis (Tichagonia) .. 35
bivalve .. 6, 168
Bivalves .. 11
bivalves .. 6, 7, 83, 98, 111, 162, 166
bivalve shell .. 173
Bivalve shells .. 187
bivalve shells .. 173
Bivalvia .. 6, 16
bladder shells .. 74
Blainvillei (Anatina) .. 173
Botula .. 41
Brachidontes .. 34
Brachyodontes .. 30, 34
Brechites .. 174
Bruguièri (Tellina) .. 156
bruguieri (Tellina) .. 154, 156

PAGES
bullata (Anatina) .. 173
bursarius (Cistopus) .. 185

C

calophylla (Anaitis) .. 125
calophylla (Chione) .. 124, 125
calophylla [Chione (Circomphalus)] .. 125, 126
calophylla [Chione (Clausinella)] .. 126
calophylla (Venus) .. 125, 126
calophylla [Venus (Chione)] .. 125
calyculata (Cardita) .. 72
canadensis (Ostrea) .. 68
candida (Scintilla) .. 83, 84
canina (Isognomon isognomum, var.) 44, 45
canina (Melina isognomum, var.) .. 45
canina (Perna) .. 45
Cardiacea .. 89
Cardiidae .. 13, 89, 187
Cardita .. 71
Carditacea .. 71
Carditidae .. 13, 71
Cardium .. 71, 72, 89, 91, 94, 96
caribaea [Modiola (Lithophagus)] .. 40
Caryatis .. 112
casta (Amphidesma) .. 152
casta (Cytherea) .. 111
casta (Meretrix) .. 111, 112, 128, 139, 141
casta (Semele) .. 151, 152
casta (Venus) .. 111
castanea (Avicula) .. 50
castanea (Pteria) .. 49, 50
Catelysia .. 100, 105, 128
caudata (Perna) .. 45
Cephalopoda .. 1, 2, 174, 187, 188, 189
Cephalopods .. 187
ceylonensis (Tapes) .. 128
chalcanthum (Arca) .. 25
Chama .. 85
Chama s. str. .. 85, 88
Chamacea .. 84
Chamidae .. 11, 84
chemnitzii (Venus) .. 120, 121
chinensis (Avicula) .. 49
chinensis (Pteria) .. 49
Chione .. 100, 103, 123

PAGES

chrysotoma (Lucina) 76
cinnamomea (Botula) 41
cinnamomea [Lithodomus (Botula)] .. 41
cinnamomea (Lithophaga) 37, 38, 41
cinnamomea (Lithophaga Botula)] .. 41
cinnamomea (Modiola) 41
cinnamomea (Mytilus) 41
cinnamomeus (Lithodomus) 41
cinnamomeus (Lithophaga) 41
cinnamopinus (Lithodomus) 41
Circe 100, 102, 105, 109
Cistopus 183, 185
clams 6, 98, 107, 139
clams (backwater) 111
Clavagella 174
Clavagellacea 173
Clavagellidae 14, 173
clavata (Pholas) 168
coarctata (Tellina) 154
coarctata [Tellina (Metis)] 154
cockles 6, 89
cock's comb oyster 69
Codakia 74, 79
complanata (Arca) 19, 20, 22
complanata [Arca (Barbatia)] .. 22
conoides (Pholas) 168
corbiculoides (Mactra) 139, 140
Corbidae 74
Corbis 74, 81
corbis (Venus) 120
Corbula 160
Corbulidae 15, 160
cordiformis (Mactra) 140
corrugata (Anatina) 173
corrugata (Laternula) 172, 173
corrugata (Lithophaga) 40
costata (Petricola) 134
costellata (Petricola) 135
Crassatella 70
Crassatellidae 14, 70
crassicosta (Beguina) 72, 73
crassicosta (Cardita) 73
crassicosta (Mytilicardia) 73
crassicosta (Venericardia) 73
crassicostatus (Pecten) 59, 60, 61
crenulata (Amphidesma) 151

PAGES

crenulata (Semele) 151, 152
crenulatum (Amphidesma) 151
cretacea (Artemis) 118
cretacea (Dosinia) 116, 118
cretacea (Dosinia prostrata, var.) .. 118
crista-galli (Mya) 68
crista-galli (Mytilus) 68
crista-galli (Ostrea) 67, 68
crista-galli [Ostrea (Lopha)] 68
cristella (Chama) 88
cristella (Pseudochama) 88
crocea (Avicula) 49
crocea (Pteria) 49
cucullata (Ostrea) 67, 187
Cucurbitula 16
cumingiana [Crenella (Modiolaria)] .. 36
cumingiana (Modiola) 36
cumingiana (Modiolaria) 36
cumingiana (Musculus) 37
cumingianus (Musculus) 36
cumingii (Avicula) 51
cumingii (Divaricella) 78
cumingii (Jouannetia) 169, 170
cumingii (Lucina) 78
cumingii [Lucina (Cyclas)] 78
cumingii [Lucina (Divaricella)] .. 78
cumingii (Pholas) 170
cumingii (Tridacna) 97
cumingii (Triomphalia) 170
cumingii (Venus) 125
cunealis (Arca) 20
cuneata (Donax) 145
cuneata [Donax (Latona)] 146
cuneata (Latona) 145
cuneata (Mactra) 139, 140
cuneata [Mactra (Trigonella)] .. 139
cuneatus (Donax) 144, 145, 146, 147, 148
cuneatus [Donax (Latona)] 146
cuneiformis (Gastrochaena) 165
cuttlebone 176
cuttlebones 178, 179, 180
cuttlefishes 175

D

Dactylina 167
dactylus (Perna) 45

PAGES

damaecocornis (Chama) 87
date shells 29
Decapoda 175, 176
decussata (Arca) 22
Dentaliidae 2, 6
Dentalium 2, 4
dentata (Lucina) 78
denticulata (Tapes) 132
Deshayesiana (Cumingia) 152
Diana's Heart Cockle 96
Dibranchiata 175
Dibranchiate Cephalopoda 188
dichotoma (Pencillus) 174
dichotomum (Aspergillum) 174
dichotomus (Brechites) 174
discors (Venus) 109
dispar (Circe) 109
dispar [Circe (Crista)] 109
dispar (Cytherea) 109
dispar (Gafrarium) 107, 109, 110
dispar s. str. (Gafrarium) 110
dispar (Venus) 109
disparilis (Arca) 24
divaricata (Arca) 24
divaricata (Byssoarca) 24
divaricata (Circe) 110
divaricata [Circe (Crista)] 110
divaricata (Crista) 110
divaricata (Cytherea) 110
divaricata (Gafrarium) 107, 110
divaricata (Lucina) 78
divaricata (Petricola) 134
divaricata (Venus) 110
divaricatum (Choristodon) 134
Divaricella 74, 78
divergens (Codakia) 79, 80
divergens [Codakia (Jagonia)] .. 80
divergens (Lucina) 80
divergens [Lucina (Codakia)] .. 80
divergens (Petricola) 134, 135
divergens [Petricola (Choristodon)] .. 134
divergens (Venus) 134
dolabrata (Pinna) 55
Donacidae 2, 13, 143
Donax 143, 146, 147, 150
Dosinia 100, 103, 115, 116, 117
dubia (Gastrochaena) 163, 165
dupuchense (Cardium) 91
Dysoni (Donax) 149
dysoni (Donax) 149

E

Eastonia 138, 142
edentula (Lucina) 75, 76, 77
edentula [Lucina (Anodontina)] .. 76
edentula [Lucina (Thyasira)] .. 76
edentula (Tellina) 155
edentula (Venus) 75
electrina (Pinna) 54
elongata (Tridacna) 97
elpis (Dentalium) 2, 5
erycina (Callista) 113
erycina (Crista) 113
erycina (Cytherea) 113
erycina (Dione) 113
erycina (Pitar) 112, 113
erycina (Venus) 113
Erycinacea 81
Erycinidae 11, 81
erythraeensis (Dactylus) 39
eucosmia (Parvilucina) 77
euglypta (Pinna) 54
Eulamellibranchia 7
Eulamellibranchiata 6, 7, 8, 70
exima (Anatina) 173
exotica (Rupellaria) 133
exotica (Venerupis) 133
exoticus (Irus) 133
exusta (Pinna) 56
exustus (Brachyodontes) 34
exustus (Mytilus) 34

F

faba (Donax) 144, 147
faba [Donax (Latona)] 147
false clams 138
false cockles 71
feather shells 6, 53
femoralis (Isognomon) 43
femoralis (Pedalion) 46
femoralis (Perna) 46
fibula (Lucina) 80
fibula [Lucina (Codakia)] 80

PAGES
filibranch 17
Filibranchia 7
fimbriata (Perna) 45
fischeri (Periglypta) 126
fischeri (Venus) 126
flavum (Cardium) 91
flavum [Cardium (Trachycardium)] 91
flexuosa (Anatina) 173
foliacea (Anaitis) 125
foliacea [Chione (Circomphalus)] 125
folium (Ostrea) 66, 69
forskalii (Ostrea) 67
forskalii (Ostrea cucullata, var.) 67
fragilis (Spirula) 177
fragum (Chama) 85, 87
fruzisa (Semele) 152
fulcata (Avicula) 52
fulcata (Pholas) 168
fulgurata (Circe) 106
fulgurata (Circe scripta, var.) 106
fumata (Pinna) 54
fusca (Arca) 17, 18, 20, 21
fusca [Arca (Barbatia)] 21
fusca (Lithophaga) 41

G

Gafrarium 100, 102, 105, 106, 108, 110, 139
Galeomma 82, 83
Galeommidae 11, 81
Gastrochaena 161, 162, 163
Gastrochaenacea 161
Gastrochaenidae 16, 161
Gastropoda 1, 187, 189
Gastropods 7
Giant Clams 12, 97
gibbia (Circe) 108
gibbia [Circe (Crista)] 108
gibbia (Crista) 108
gibbia (Cytherea) 108
gibbosa (Circe) 108
gigantea (Fistulina) 163
gigantea (Gastrochaena) 163, 164, 165
gigantea (Rocellaria) 163
glabrata (Crassatella) 136
glabrata (Mesodesma) 136
glabrata [Mesodesma (Atactodea)] 136

PAGES
glabrata (Paphia) 136
glabratum (Mesodesma) 136, 137
glabratum [Mesodesma (Paphia)] 136
globosa (Jouannetia) 169, 170
globosa (Pholas) 170
globosa (Triomphalia) 170
globosus (Axinus) 76
globulosa (Jouannetia) 169, 170
globulosa [Jouannetia (Triphlia) 170
globulosa (Pholas) 170
Glycimeridae 8, 27
Glycimeris 27
Gorgonian 49
Gorgonian *corals* 50
gracilis (Lithodomus) 39
gracilis (Lithophaga) 38, 39, 40
gracilis (Modiola) 39
gracilis [Modiola (Lithophagus)] 39
gradata (Arca) 24
gradata [Arca (Acar)] 24
granosa (Donax) 145
granulatus (Octopus) 184
granulatus (Polypus) 184
gubernaculum (Arca) 19, 25
gubernaculum [Arca (Anadara)] 25
gubernaculum (Pinna) 56

H

hammer oysters 42, 47
hanleyi (Scintilla) 83, 84
herdmanni (Pentaceros) 55
Heterodonta 11, 70
hians (Vulsella) 47
hispida (Arca) 24
histrio (Cytherea) 117
histrio (Dosinia) 116, 117
histrio [Dosinia (Austrodosinia)] 117
histrio (Venus) 116
honkongensis (Octopus) 183, 184
honkongensis (Paroctopus) 183
honkongensis (Polypus) 183
horse mussel 41
horse mussels 29

I

imbricata (Arca) 20
imbricata (Plicatula) 58
imbricata (Venus) 120, 122

PAGES
imperialis (Spondylus) 62, 63
impressa (Gastrochaena) 162. 163
inaequivalvis (Arca) 19, 20, 24
incarnata (Donax) 148, 149
incarnatus (Donax) 145, 148, 149
incarnatus [Donax (Serrula)] 149
Incirrata 183
indica [Arca (Scapharca] 25
indica (Loligo) 181, 182
indica (Sepioteuthis) 182
Indica (Tapes) 132
indicus (Cistopus) 185
indicus (Octopus) 185
indicus (Tapes) 132
indistincta (Gastrochaena) 162, 164, 165
indistincta (Rocellaria) 164
inermis (Sepia) 178
inermis (Sepiella) 178
iridescens (Avicula) 49
Irus 100, 102, 133
Irus (Venerupis) 127
Isognomon 42, 43, 44
Isognomon (Ostrea) 45
Isognomonidae 11
Isognomum (Isognomon) 45
isognomum (Perna) 45, 46

J

Japonica (Tapes) 122
Jouannetia 166, 169, 170

K

Kraussi (Arca) 20

L

labiata (Anatina) 173
lacunosa (Tellina) 154
lacunosa [Tellina (Metis)] 154
Laeda 16
Lamarckii (Chione) 123
Lamarckii (Solen) 159
lamarckii (Solen) 158, 159
Lamarckii (Venus) 123
lamellaris (Antigona) 123
lamellaris (Chione) 123
lamellaris [Chione (Antigona)] .. 123
lamellaris (Venus) 123
lamellaris [Venus (Antigona)] 123

PAGE
lamellatum (Cardium) 92
Lamellibranches 187, 188
Lamellibranchiata 6, 188, 189
Lamellibranchs 7, 91, 126, 188
lamellibranchs 6
lamellibranch *shells* 2
lamellosa (Gastrochaena) 162, 163, 164, 165
lamellosa (Rocellaria) 164
laminata [Barbatia (Acar)] 24
lanceolata (Tridacna) 97
lapicida (Naranio) 134
lapicida (Petricola) 134
lapicida [Petricola (Naranio)] 134
lapicidum (Choristodon) 134
lateralis (Arca) 18, 20, 23
Laternula 172
Laternulidae 15, 172
laticostata (Perna) 45
latum (Cardium) 93
layardi (Spondylus) 62, 63, 64
lazarus (Chama) 86, 87
leaf oyster 69
Leda 16
Ledidae 8, 16
legumen (Isognomon) 44, 45
Legumen (Ostrea) 45
legumen (Ostrea) 45
legumen (Perna) 45
lentiginosa (Tapes) 131
Lentillaria 79
Lima 64
lima (Cardium) 92
lima (Lima) 64
lima [Lima (lima)] 64
lima (Ostraea) 64
lima (Radula) 64
Limidae 10, 64
Limopsidae 8, 28
Limopsis 28
linguaeformis (Isognomon) 45
linguaeformis (Perna) 45
lingulata (Vulsella) 47
literata (Venus) 131
Lithodomus 37
Lithophaga 29, 37, 41
lithophaga (Petricola) 134, 135

PAGES
lithophaga (Venus) 135
lithophagus (Lithodomus) 40
lithophagus (Mytilus) 40
Loliginacea 180
Loliginidae 176, 180
Loligo 180
lubrica (Donax) 145, 148, 149
Lucina 74, 75
Lucinacea 74, 187
lucinalis (Petricola) 134
Lucinidae 11, 74, 78, 80
Lunulicardia 89, 95
lurida (Mactra) 139
lurida (Trigonella) 139
luzonica (Arca) 25

M

macrophylla (Rupellaria) 127
macrophylla (Venerupis) 127, 133
Mactra 138, 139, 141, 142, 143
Mactracea 135
Mactridae 2, 14, 137
maculata (Arca) 20
maculata (Byssoarca) 20
madida (Pinna) 54
madrasensis (Ostrea) 66, 68
major (Vulsella) 47
Malabarica (Paphia) 130
malabarica (Paphia) 129, 130, 131
Malabarica (Tapes) 130
malabarica (Tapes) 131
Malabarica (Venus) 130
Malabaricus (Tapes) 131
Malabaricus [Tapes (Paratapes)] .. 131
Malleus 42, 43, 47
malleus (Malleus) 47, 48
malleus (Ostraea) 47
mannarense (Dentalium) 2, 5
Margaritifera 188
margaritifera (Avicula) 51
margaritifera (Margaritifera) 51
margaritifera (Meleagrina) 51
margaritifera (Mytilus) 51
margaritifera (Pinctada) 51
margaritiferus (Mytilus) 51
marmorata (Circe) 109

PAGES
Martesia 166, 168, 169, 171
Martesia sp. 169
mauritiana (Laeda) 16
mauritiana (Leda) 16
mauritiana (Nucula) 16
mauritiana (Nuculana) 16
maxima (Tridacna) 97
mera (Mactra) 138, 140
mera [Mactra (Mactra)] 140
mera (Trigonella) 140
Meretrix 100, 102, 111, 187
meretrix (Meretrix) 111
Meroë 115
meroë (Sunetta) 115
Mesodesma 136
Mesodesmatidae 14, 135
metcalfei (Modiola) 31, 32
metcalfei (Modiolus) 31, 32, 33
micra (Chione) 124
mitis (Mesodesma) 136
modesta (Aloides) 160, 161
modesta (Artemis) 117
modesta (Corbula) 160
modesta (Cytherea) 117
modesta (Dosinia) 116, 117, 119
modesta (Dosinia prostrata, var.) .. 117
Modiola 30, 36
Modiolaria 36
Modiolus 30, 32, 33
Mollusca 1, 2, 187, 188, 189
molluscan *shells* 16
Molluscs 6, 188
Mother-of-Pearl Oysters 50, 188
multiplicata (Plicatula) 58
Musculus 30, 36
mussels 6
mutica (Pinna) 54, 55
muticum (Cardium) 95
Myacea 160
Myopsida 177
Mytilacea 29
Mytilidae 9, 29
mytilina (Vulsella) 47
Mytilus 29, 34, 41

PAGES

N

nana (Crenella) .. 37
nana (Lanistina) .. 37
nana (Modiola) .. 37
nana (Modiolaria) .. 37
nana (Pholas) .. 168
nanus (Musculus) .. 36, 37
natator (Gyrineum) .. 20
Nautilus .. 175
navicularis (Arca) .. 20
nicobarica (Anatinella) .. 142
nicobarica [Eastonia (Merope)] .. 142
nicobarica (Mactra) .. 142
nicobarica (Spisula) .. 142
nicobarica (Standella) .. 142
nicobarica [Standella (Eastonia)] .. 142
nicobaricus (Mytilus) .. 35
nicobaricus (Septifer) .. 35
nigra .. 56
nigra (Lithodomus) .. 40
nigra (Lithophaga) .. 38, 40
nigra (Pinna) .. 56
nigrina (Pinna) .. 56
nobilis (Cytherea) .. 114
nobilis (Dione) .. 114
nobilis (Pitar) .. 112, 113, 114
nodulosa (Venus) .. 123
norma (Isognomon) .. 46
norma (Isognomon isognomum, var.) 43, 46
nucleus (Isognomon) .. 43, 44
nucleus (Melina) .. 44
nucleus (Perna) .. 44
Nuculacea .. 16
Nuculana .. 16
Nuculanidae .. 8, 16
Nuculidae .. 16

O

occa (Avicula) .. 52
octangulatum (Dentalium) .. 3, 4, 6
octogonum (Dentalium) .. 3, 4
Octopoda .. 175, 183
Octopodacea .. 183
Octopodidae .. 175, 183
octopods .. 183
Octopus .. 183, 184
octopuses .. 175
Oigopsida .. 176

PAGES

opima (Catelysia) .. 112, 128, 139, 141
opima (Venus) .. 128
orbicularis (Placenta) .. 65
orientalis (Dactylina) .. 167
orientalis (Monothyra) .. 167
orientalis (Pholas) .. 167
orientalis [Pholas (Dactilina)] .. 167
orientalis [Pholas (Monothyra)] .. 167
orientalis (Phragmopholas) .. 167
Ostracea .. 66
Ostrea .. 66, 69
Ostreidae .. 9, 66
ovoidea (Pholas) .. 169
ovum (Lucina) .. 75, 76, 77
ovum [Lucina (Thyasira)] .. 76
ovum (Meretrix) .. 111
oyster .. 67
oysters .. 6, 66, 69, 86

P

pallida (Octopus boscii, var.) .. 184
Pandoracea .. 172
paper Nautilus .. 175
paper shells .. 6, 153
Paphia .. 100, 105, 129
papilionacea (Pullastra) .. 130
papilionacea (Tapes) .. 130
papilionacea (Venus) .. 130
papilionaceus [Tapes (paratapes)] .. 130
papyracea (Papyridea) .. 95
papyraceum (Cardium) .. 90, 95
papyraceum [Cardium (papyridea)] .. 95
patibulum (Perna) .. 45
paucistriata (Galeomma) .. 82, 83, 84
paxillus (Donax) .. 149
Pearl Oyster (Indian) .. 53
Pearl Oysters .. 188
pearl oysters .. 49
pearls .. 42
Pecten .. 57, 58, 59, 61
Pectinacea .. 57
pectinata (Circe) .. 109
pectinata [Circe (Crista)] .. 109
pectinata (Crista) .. 109
pectinata (Cytherea) .. 108
pectinata (Gafrarium) .. 109

PAGES
pectinata (Perna) 44
pectinata (Venus) 108
pectinatum (Cytherea) 108
pectinatum (Gafrarium) 107, 108, 109
Pectinidae 10, 57
Pectiniforme (Cardium) 91
Pectininae 10, 58
Pedalion 42, 43
Pelecypoda 1, 6, 7, 16, 187 188, 189
pellucida (Standella) 142
pepper-pot shell 174
pepper-pot shells 173
perfragilis (Modiola) 32
perfragilis (Modiolus) 31, 32
perfragilis (Volsella) 32
Periglypta 100, 104, 126
peronii (Spirula) 177
personata (Circe) 106
personatum [Gafrarium (Circe)] .. 105
perviridis (Avicula) 52
Petricola 13, 134
Petricolidae 13, 134
pharaonis (Mytilus) 34
Philippiana (Loripes) 76
philippiana (Lucina) 76
Philippinarum (Tapes) 132
philippinarum (Tapes) 131, 132
Philippinarum [Tapes (Cuneus)] .. 132
Philippinarum [Tapes (Ruditapes)] .. 132
Philippinarum [Venus (Pullastra)] .. 132
philippinensis (Pinna) 54
philippinensis (Rocellaria) 165
Pholadidae 16, 166
Pholadidea 166, 171
Pholadidea sp. 171
Pholas 166, 167
Piddocks 166
pila (Lucina) 76
Pinctada 48, 49, 50
pinguis (Tapes) 128
pinguis (Venus) 128
Pinna 54, 55, 189
Pinna s. str. 54
Pinnidae 9, 53
pisum (Lucina) 75, 77
pisum [Lucina (Codakia)] 77
PAGES
pisum [Lucina (Phacoides)] 77
Pitar 100, 104, 112 114
Placenta 65
placenta (Anomia) 65
placenta (Placenta) 65
placenta (Placuna) 65
plica (Ostraea) 61
plica (Pecten) 59, 61
plica [Pecten (Pallium)] 61
plicata (Arca) 17, 18, 20, 24
plicata [Arca (Acar)] 24
Plicatula 57, 58
Plicatulinae 57
plicatus (Pecten) 61
Polypus 183
prostrata (Dosinia) 118
prostrata s. str. (Dosinia) 118
Protobranchia 7
prototypos (Spirula) 177
Pseudochama 85, 88
Pteria 48, 49, 52
Pteriacea 42
Pteriidae 2, 9, 48
puella (Dosinia) 116, 119
pulchrum (Cardium) 94
punctatus (Octopus) 183
pusillus (Pholas) 168

Q

quadrangularis (Perna) 44

R

radians (Donax) 147
radians [Donax (Latona)] 147
radiata (Avicula) 49, 52
radiata (Donax) 147
radiata (Machaera) 158
radiata (Siliqua) 157, 158
radiata (Venus) 131
radiatus (Cultellus) 158
radiatus (Siliqua) 157
radiatus (Solen) 158
radiatus (Tapes) 131, 132
radiatus [Tapes (Parembola)] 131
ram's horn shell 177
Ranella (Circe) 108
razor shells 157, 158, 159
Reeveana (Chama) 88

PAGES
Reevei (Tridacna) 97
reflexa (Chama) 85, 86, 87, 88
regia (Pinna) 54, 55
reticulata (Antigona) 120
reticulata (Chione) 120
reticulata (Venus) 120, 121, 126
reticulata, var. (Venus) 126
retusa (Lunulicardia) 96
retusum (Cardium) 96
retusum [Hemicardium (Lunulicardia)] 96
rhombifera (Venus) 130
rhomboidalis [Arca (Scapharca)] .. 24
Ringicardium 89
roccellaria (Petricola) 135
Roccellaria 162
Roccellariidae 16, 161
rock oyster 67
rostrata (Crassatella) 70, 137
rostrata (Mactra) 70
rostrata (Ostrea) 68
rotundata (Tapes) 130
rouxii (Acanthosepion) 179
rouxii (Sepia) 179
rudis (Pinna) 56
rugosa Indiae orientalis (Mactra) .. 142
rugosa (Sepia) 184
rugosum (Cardium) 91
rugosus (Octopus) 183, 184
rugosus [Octopus (Octopus)] 184
rugosus (Polypus) 184
ruperella (Petricola) 135

S

satparensis [Corbicula (Velorita)] .. 111
scabra (Chione) 124
scabra [Chione (Omphaloclathrum)] 124
scabra [Chione (Timoclea)] 124
scabra (Dosinia) 117
scabra (Venus) 124
scabra [Venus (Chione)] 124
scallop 60
scallops 6, 57
scalpellum (Tellina) 154, 156
Scaphopoda 1, 2, 187, 189
Scintilla 82, 83
scortum (Donax) 144, 146
scortum (Hecuba) 146

PAGES
scripta (Circe) 105, 106
scripta (Cytherea) 105, 106
scripta (Donax) 115
scripta (Meroe) 115
scripta (Sunetta) 115
scripta (Venus) 105
scriptus (Cuneus) 115
Semele 150
Semelidae 14, 150
semicostata (Pholas) 168
semidecussata (Tapes) 132
semigranosus (Donax) 149
semilamellata (Petricola) 135
semperiana (Lucina) 77
semperiana [Lucina (Cyclas)] 77
semperianus [Phacoides (Bellucina)] .. 77
senatorius (Pecten) 61
Sepia 178, 179
Sepiacea 176
Sepiella 178
Sepiidae 176, 177
Sepioteuthis 180, 181
Septibranchia 7
Septifer 30, 34, 35, 41
setosum (Cardium) 90, 93
setosum [Cardium (Acanthocardium)] 93
silicula (Mytilus) 41
Siliqua 157
sinensis (Margarita) 51
siphonata (Anatina) 172, 173
smaragdinus (Mytilus) 42
Solen 157, 158
Solenacea 157
Solenidae 15, 157
sowerbyi (Corbis) 81
spengleri (Perna) 45
spinosus (Donax) 144, 149
Spirula 176
spirula (Nautilus) 177
spirula (Spirula) 176, 177
Spirulidae 175, 176
splendidulus (Pecten) 59, 60, 61
Spondylinae 10, 62
Spondylus 57, 58, 62
squamifera (Cardita) 73
squamosa (Barbatia) 24
squamosa (Lima) 64

PAGES

squids .. 175
Standella .. 138, 142
starfish .. 55
straminea (Lithophaga) .. 40
stramineus (Lithodomus) .. 40
stramineus (Lithophaga) .. 38, 40
striata (Amphidesma) .. 152
striata (Martesia) .. 168, 169
striata (Mesodesma) .. 137
striata (Petricola) .. 135
striata (Pholas) .. 168
striata [Pholas (Martesia)] .. 168
striata (Semele) .. 151, 152
striata [Semele (Amphidesma)] .. 152
striatulum (Dentalium) .. 4
striatus (Pholas) .. 168
subretusum (Cardium) .. 96
subretusum [Cardium (Lunulicardia)] 96
subrostrata (Anatina) .. 172, 173
subrostrata (Venus) .. 123
sugillata (Circe) .. 106
sulculosa (Aloides) .. 160, 161
sulculosa (Corbula) .. 161
Sunetta .. 100, 104, 115
sunset shell .. 158
sunset shells .. 157
symmetrica (Arca) .. 19, 22, 23
symmetrica [Arca (Barbatia)] .. 22
symmetrica [Arca (Fossularca)] .. 22
symmetrica (Barbatia) .. 22

T

Tapes .. 100, 105, 131
Taxodonta .. 6, 7, 16
taylori (Glycimeris) .. 27
taylori (Pectunculus) .. 27
Tellina .. 153, 155, 156
Tellinacea .. 143
Tellinidae .. 2, 14, 153, 187
teredinaeformis (Pholas) .. 168
teres (Lithodomus) .. 39
teres (Lithophaga) .. 38, 39, 40
teres [Lithophaga (Lithophaga)] .. 39
teres (Lithophagus) .. 39
teres (Modiola) .. 39
Tetrabranchiata .. 174

PAGES

tetragona (Arca) .. 20
textile (Paphia) .. 129, 130
textile [Paphia (Paratapes)] .. 129
textile (Tapes) .. 129
Textile (Venus) .. 129
textile (Venus) .. 129
textrix (Tapes) .. 129
textrix [Tapes (Paratapes)] .. 129
textrix [Tapes (Textrix)] .. 129
thiara (Anaitis) .. 125
thiara (Venus) .. 125
tiara (Anaitis) .. 125
tiara (Antigona) .. 125
tiara (Chione) .. 124, 125
tiara [Chione (Circomphalus)] .. 125
tiara [Chione (Clausinella)] .. 125
tiara (Venus) .. 125
timorensis (Scintilla) .. 83, 84
torta (Arca) .. 26
tortuosa (Arca) .. 17, 26
tortuosa [Arca (Parallelipedum)] .. 26
tortuosa [Arca (Trisidos)] .. 26
tortuosum (Parallelipedum) .. 26
Trachycardium .. 89
traillii (Modiola) .. 33
traillii (Modiolus) .. 31, 33
tranquebarica (Ostraea) .. 59
tranquebaricus (Pecten) .. 59, 61
tranquebaricus (Perna) .. 46
Trapezium .. 72
Tridacna .. 97
Tridacnidae .. 12, 97
trigona (Artemis) .. 118
trigona (Cytherea) .. 118
trigona (Dosinia) .. 116, 118, 119
trigona (Mesodesma) .. 136, 137
trigona (Paphia) .. 137
trigonum (Pinna) .. 54
trigonum (Mesodesma) .. 137
trita (Vulsella) .. 47
true cockles .. 71
tulipa (Modiola) .. 33
tulipa (Modiolus) .. 31, 33
tumida (Mactra) .. 140
tumidum (Gafrarium) .. 107, 108, 109
turgida (Mactra) .. 138, 140, 141, 142

PAGES

turgida [Mactra (Coelomactra)] .. 140
tusk shells 2

U

undatina (Circe) 106
undatina (Cytherea) 105

V

variabilis (Brachidontes) 34
variabilis (Brachyodontes) 34
variabilis (Modiola) 34
variabilis (Mytilus) 34
variegata (Actinobolus) 72
variegata (Artemis) 117
variegata (Beguina) 72, 73
variegata (Cardita) 72
variegata [Cardita (Arcinella)] .. 72
variegata (Dosinia) 117
variegata (Mytilicardia) 72
velata (Arca) 22
velata (Barbatia) 22
velata (Byssoarca) 22
Veneracea 98
Venerid 112
Veneridae 13, 98, 99, 100, 101, 102
Venerupis 100, 103, 127
Venus 100, 104, 119, 122, 123, 126, 188
vesicula (Cryptodon) 77
vesicula (Lucina) 75, 77
vesicula [Lucina (Thyasira)] 77
vespertilio (Pedalion) 45
vespertilio (Perna) 45
vespertina (Pinna) 54
vexillum (Pinna) 54, 56
vexillum [Pinna (Atrina)] 56
violacea (Mactra) 139, 141
violacea [Mactra (Coelomactra)] .. 141
violacea (Trigonella) 141
virgata (Pinna) 54
virginiana (Ostrea) 68
viridis (Mytilus) 41, 42
viridis [Mytilus (Chloromya)] 42
volucris (Arca) 20
vulgaris (Malleus) 47, 48
vulgaris (Margaritifera] 52
vulgaris (Perlamter) 52
vulgaris (Pinctada) 51, 52
vulgaris [Pteria (Margaritifera)] .. 52
vulgaris (Pullastra) 129
Vulsella 11, 42, 43, 46, 47
vulsella (Mya) 47
vulsella (Vulsella) 47
Vulsellidae 11, 42

W

watering-pot shell 174
watering-pot shells 178
wedge shells 6, 143
window-pane oyster 65
wing mussels 49

X

xylophaga (Pholas) 168

Z

Zebulensis (Pinna) 54

NOTE.—All the illustrations are drawn to natural size except where otherwise stated. Wherever figures are drawn enlarged or reduced, the extent of the magnification or reduction is indicated in the explanations of the corresponding figures.

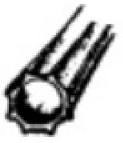
PLATE I.

Fig. 1*a*. *Dentalium octangulatum* Donovan,(entire shell).
,, 1*b*. *Dentalium octangulatum* Donovan, (apertural view).
,, 2*a*. *Dentalium aprinum* Linné, (entire shell).
,, 2*b*. *Dentalium aprinum* Linné, (apertural view).
,, 3*a*. *Dentalium mannarense* Winckworth, (entire shell).
,, 3*b*. *Dentalium mannarense* Winckworth, (apertural view).
,, 4*a*. *Dentalium elpis* Winckworth, (entire shell).
,, 4*b*. *Dentalium elpis* Winckworth, (apertural view).

PLATE I

1a

2a



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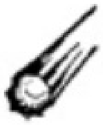
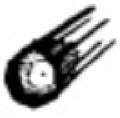


2b

3a

4a



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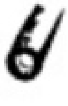
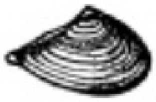


4b

PLATE II.

Fig. 1*a*. *Nuculana mauritiana* (Sowerby), × 2, (outer view).
,, 1*b*. *Nuculana mauritiana* (Sowerby), × 2, (inner view).
,, 2*a*. *Arca avellana* Lamarck, (inner view).
,, 2*b*. *Arca avellana* Lamarck, (dorsal view).
,, 2*c*. *Arca avellana* Lamarck, (end view).
,, 3*a*. *Arca fusca* Bruguière, (outer view).
,, 3*b*. *Arca fusca* Bruguière, (inner view).
,, 4*a*. *Arca complanata* Chemnitz, (outer view).
,, 4*b*. *Arca complanata* Chemnitz, (inner view).
,, 5*a*. *Arca symmetrica* Reeve, × 2, (outer view).
,, 5*b*. *Arca symmetrica* Reeve, × 2, (inner view).
,, 6*a*. *Arca lateralis* Reeve, (outer view).
,, 6*b*. *Arca lateralis* Reeve, (inner view).
,, 7*a*. *Arca inaequivalvis* Bruguière, (outer view).
,, 7*b*. *Arca inaequivalvis* Bruguière, (hinge view).
,, 8*a*. *Arca gubernaculum* Reeve, (outer view).
,, 8*b*. *Arca gubernaculum* Reeve, (hinge view).

PLATE II



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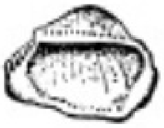

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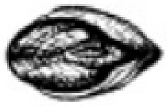

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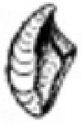

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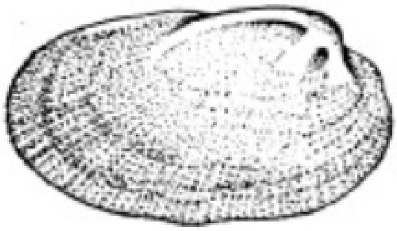

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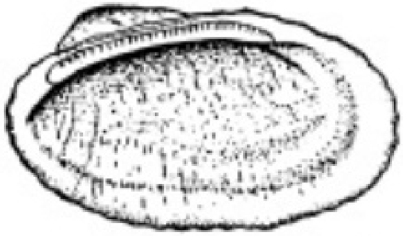

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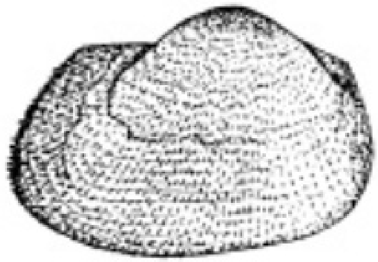

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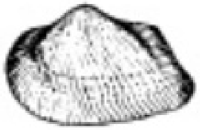

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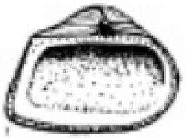

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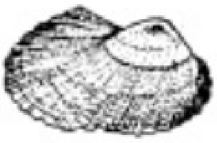

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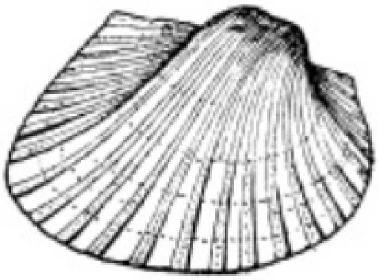

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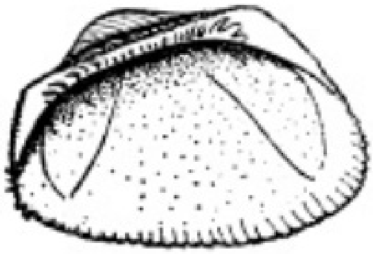

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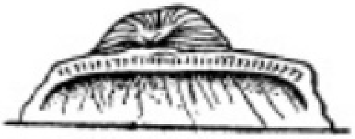

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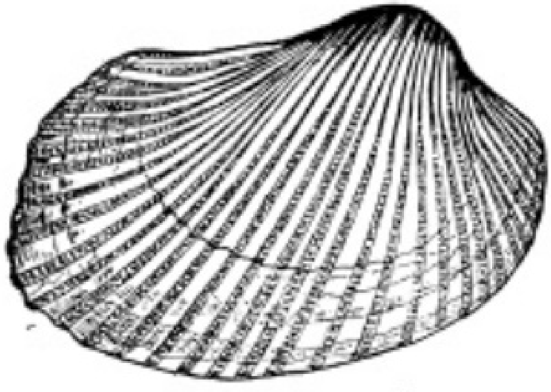

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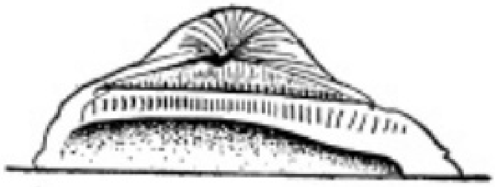
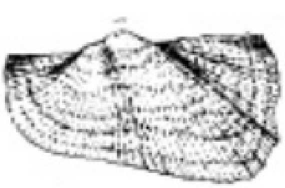


8b

PLATE III.

Fig. 1*a*. *Arca tortuosa* Linnè, (outer view).
,, 1*b*. *Arca tortuosa* Linné, (inner view).
,, 2*a*. *Glycimeris taylori* (Angas) × 2, (outer view).
,, 2*b*. *Glycimeris taylori* (Angas) × 2, (inner view).
,, 3*a*. *Limopsis belcheri* (Adams & Reeve), (outer view).
,, 3*b*. *Limopsis belcheri* (Adams & Reeve), (inner view).
,, 4*a*. *Modiolus metcalfei* (Hanley), (outer view).
,, 4*b*. *Modiolus metcalfei* (Hanley), (inner view).
,, 5. *Modiolus perfragilis* (Dunker) × 2, (outer view).
,, 6*a*. *Modiolus tulipa* (Lamarck), (outer view).
,, 6*b*. *Modiolus tulipa* (Lamarck), (inner view).



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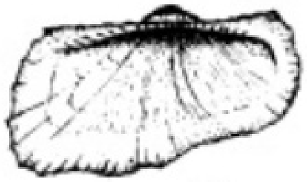

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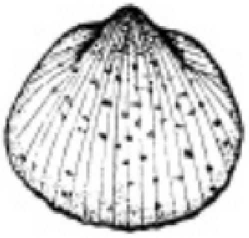

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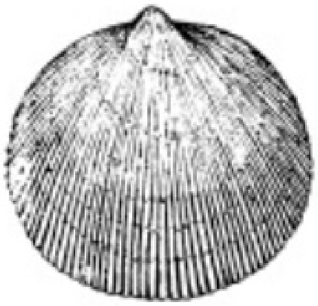

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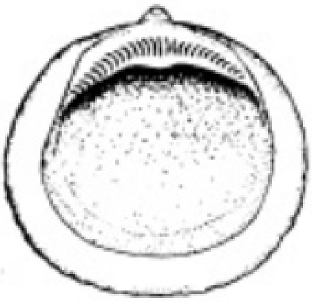

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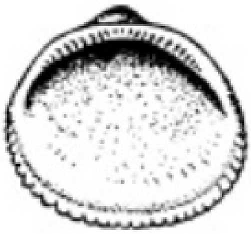

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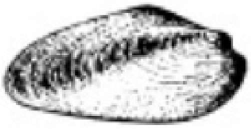

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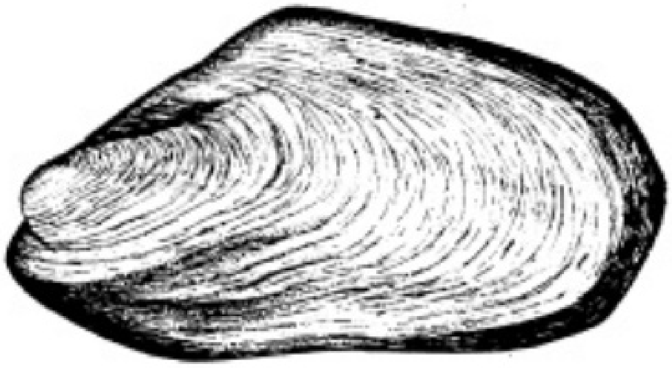

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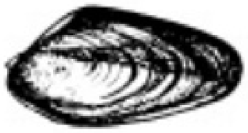

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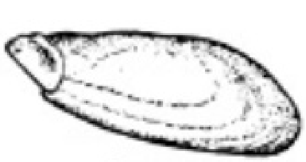
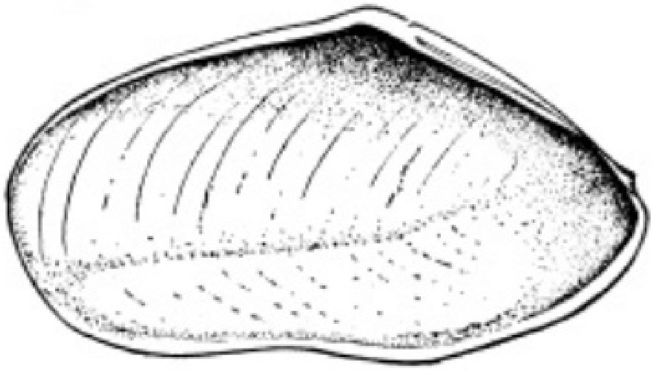


5

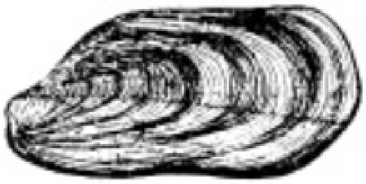


6b

6b

PLATE IV.

Fig. 1. *Modiolus traillii* (Reeve), (outer view).
" 2. *Brachyodontes variabilis* (Krauss), × 2, (entire view of spirit specimen).
" 3*a*. *Septifer bilocularis* (Linné), (outer view).
" 3*b*. *Septifer bilocularis* (Linné), (outer view).
" 4. *Musculus cumingianus* (Dunker), × 4, (outer view).
" 5. *Musculus nanus* (Dunker), × 4, (outer view).
" 6*a*. *Lithophaga teres* (Philippi), (dorsal view).
" 6*b*. *Lithophaga teres* (Philippi), (outer view).
" 7*a*. *Lithophaga gracilis* (Philippi), (outer view).
" 7*b*. *Lithophaga gracilis* (Philippi), (inner view).
" 8. *Lithophaga nigra* (d'Orbigny), (outer view).
" 9. *Lithophaga straminea* (Dunker), young shell, (outer view).
" 10*a*. *Lithophaga cinnamomea* (Lamarck), (outer view).
" 10*b*. *Lithophaga cinnamomea* (Lamarck), (inner view).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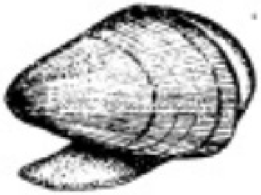
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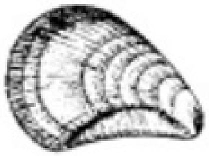
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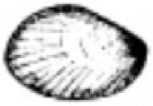
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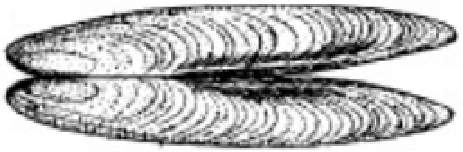
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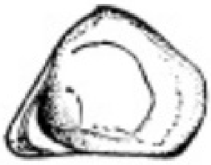
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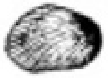
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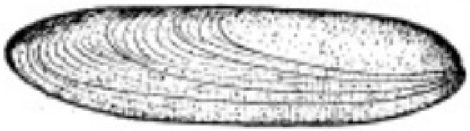
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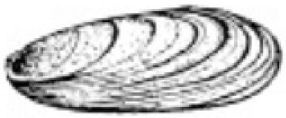
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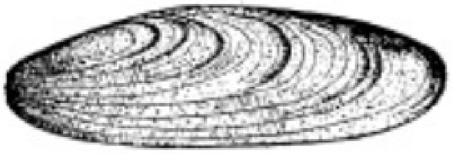
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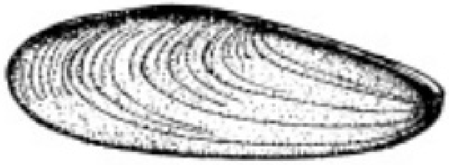
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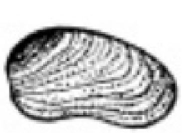
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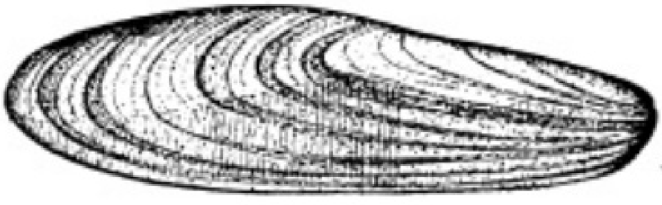
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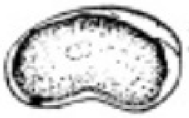
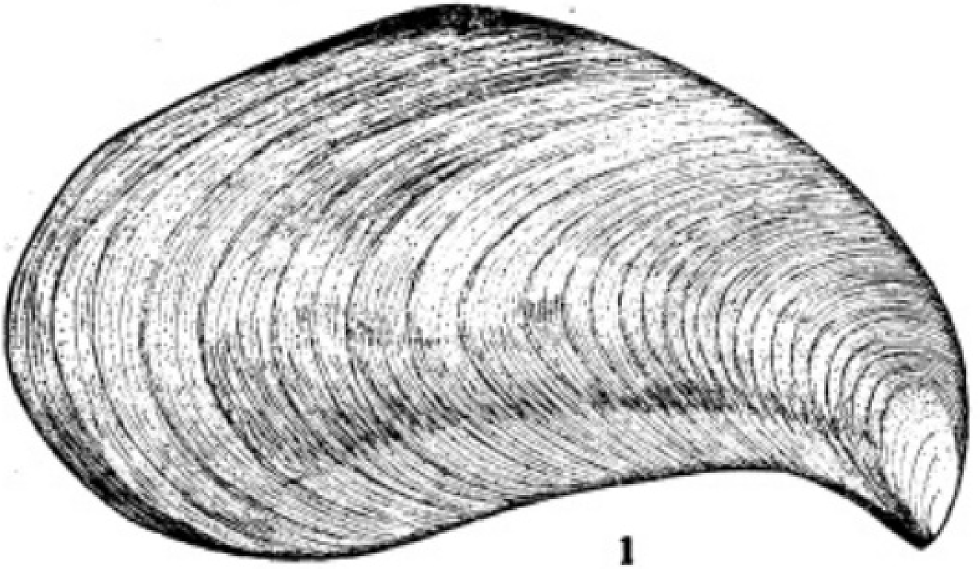


10b

PLATE V.

Fig. 1. ***Mytilus viridis*** Linnè, (outer view).
" 2*a*. *Isognomon nucleus* (Lamarck), × 2, (outer view).
" 2*b*. *Isognomon nucleus* (Lamarck), × 2, (inner view).
" 3*a*. *Isognomon legumen* (Gmelin), (outer view).
" 3*b*. *Isognomon legumen* (Gmelin), (inner view).
" 4. *Isognomon isognomon* (Linnè), var *canina* (Lamarck), spirit specimen, (outer view).
" 5*a*. *Isognomon isognomon* (Linnè), var. *norma* Röding, (outer view).
" 5*b*. *Isognomon isognomon* (Linnè), var. *norma* Röding, (inner view).
" 6*a*. *Vulsella vulsella* (Linnè), (outer view).
" 6*b*. *Vulsella vulsella* (Linnè), (inner view).

PLATE V



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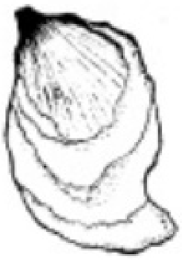

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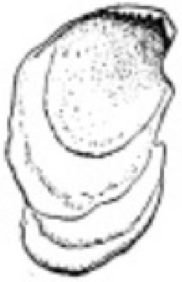

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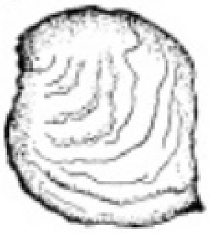

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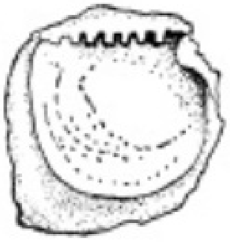

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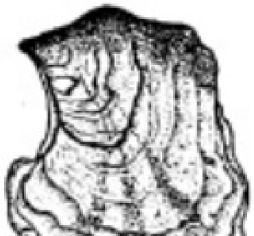

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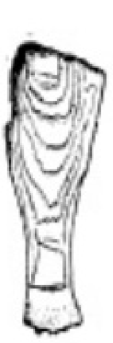

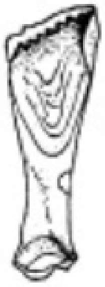

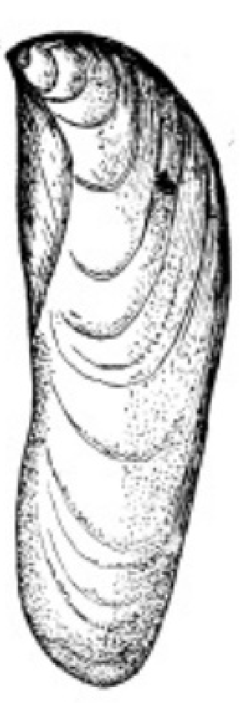

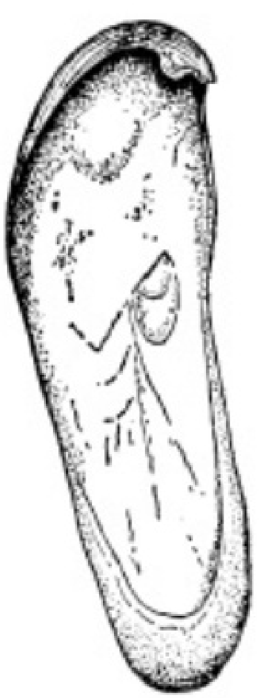

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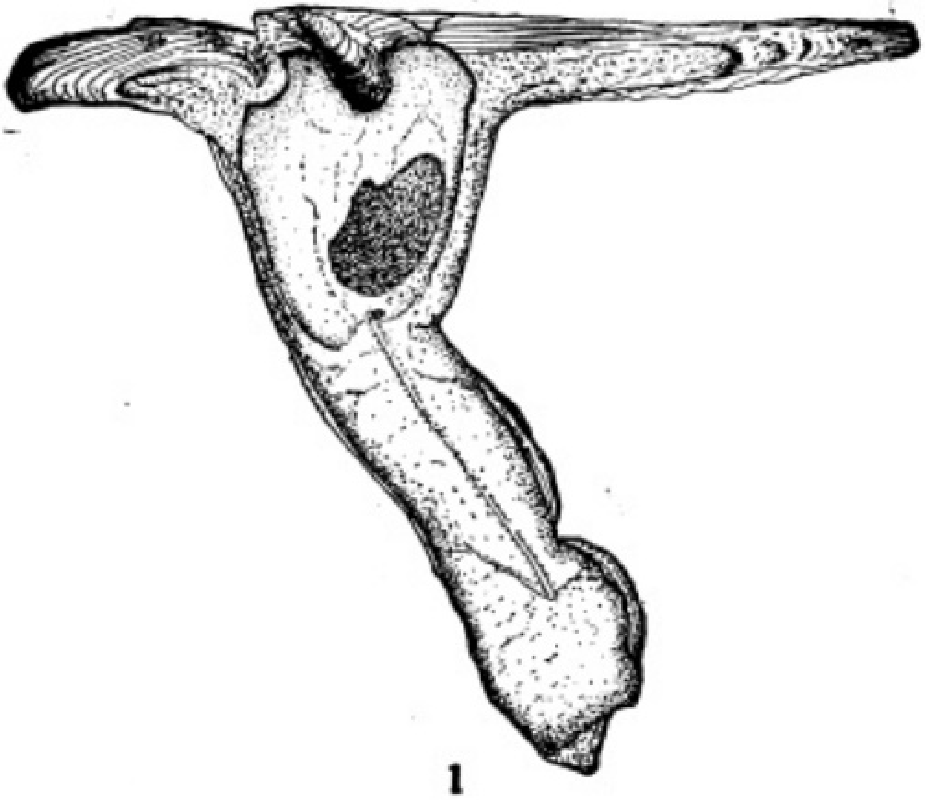

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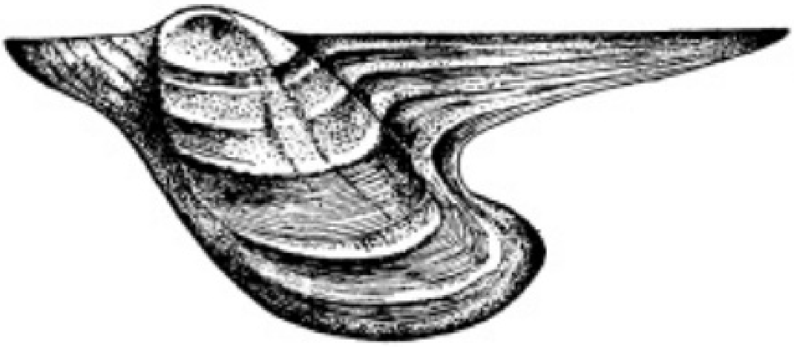

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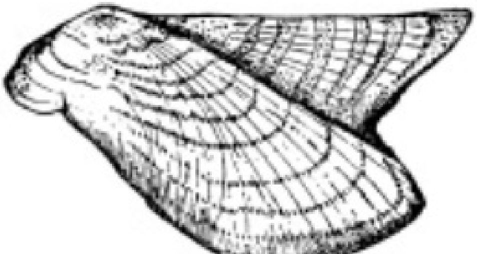
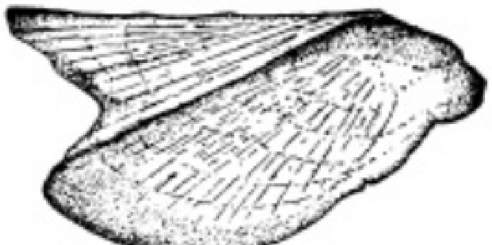


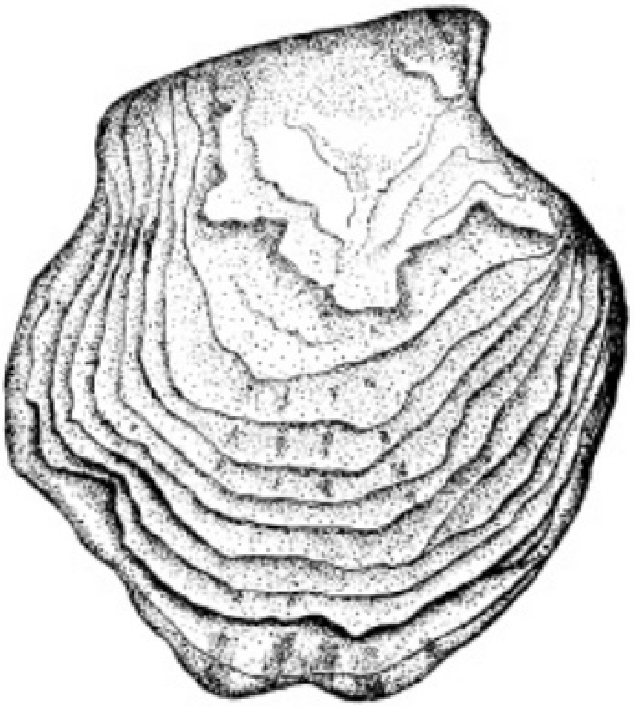


3a

3b

PLATE VII.

Fig. 1*a*. *Pinctada margaritifera* (Linné), (outer view).
„ 1*b*. *Pinctada margaritifera* (Linné), (inner view).
„ 2*a*. *Pinctada vulgaris* (Schumacher), (outer view).
„ 2*b*. *Pinctada vulgaris* (Schumacher), (inner view).
„ 3*a*. *Pinctada anomioides* (Reeve), (outer view).
„ 3*b*. *Pinctada anomioides* (Reeve), (inner view).



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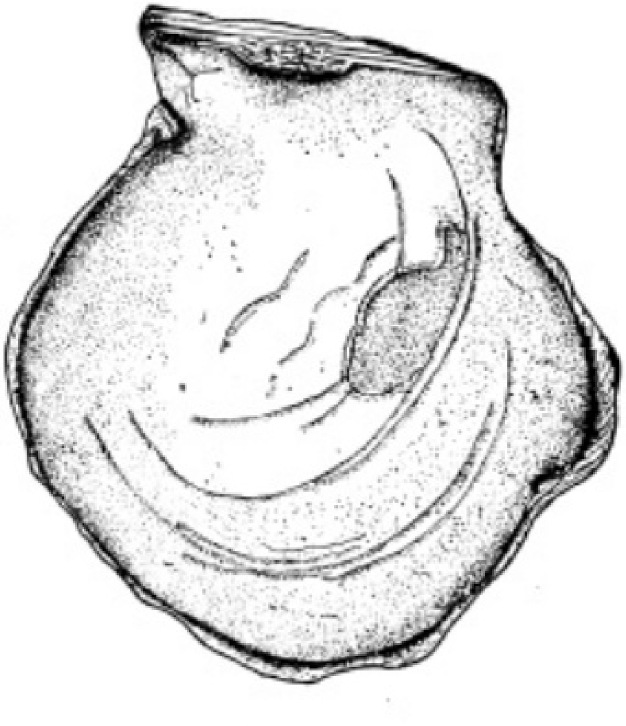

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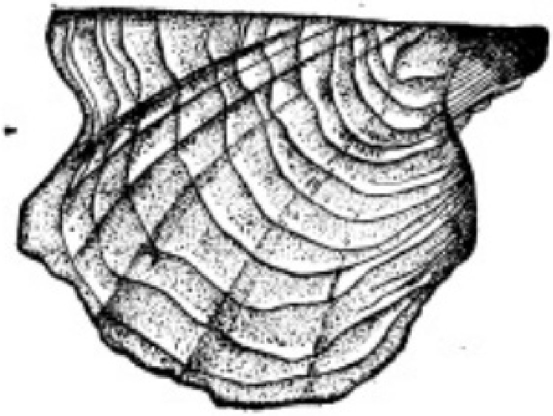

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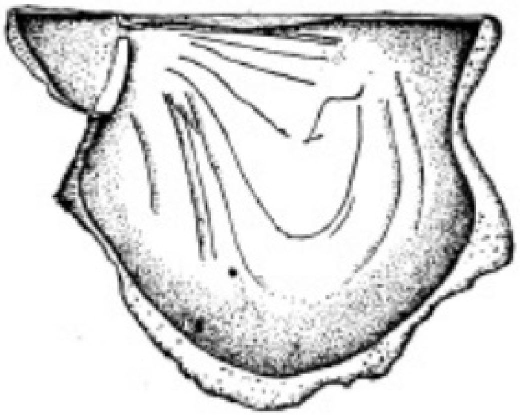

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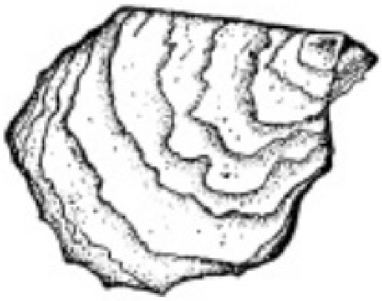

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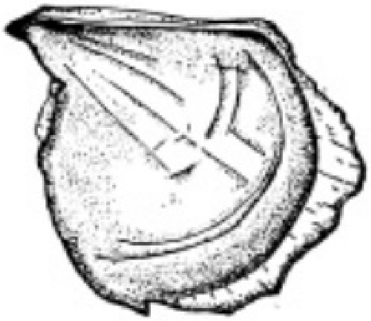
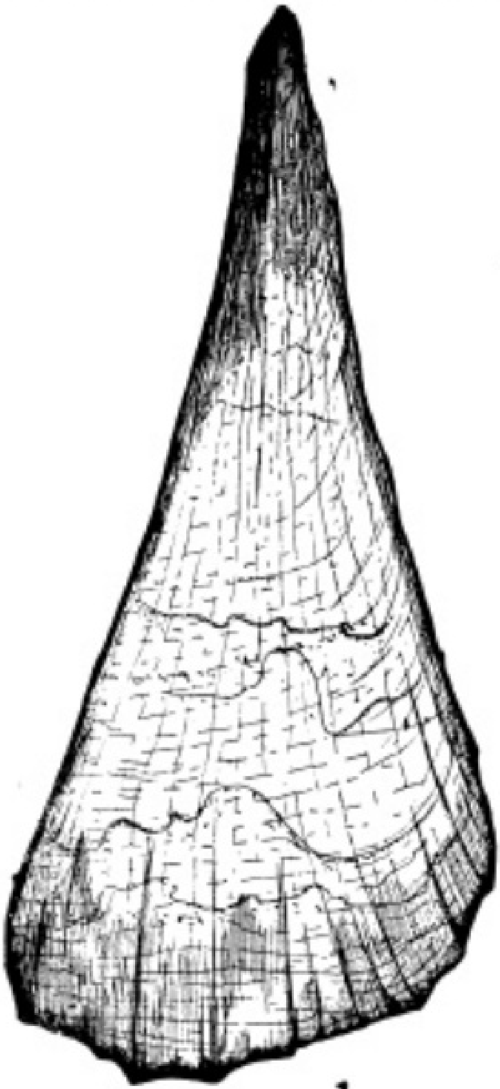


3b

PLATE VIII.

Fig. 1. *Pinna atropurpurea* Sowerby × $\frac{1}{2}$, (outer view).
,, 2. *Pinna bicolor* Gmelin × $\frac{1}{2}$, (outer view).
,, 3. *Pinna vexillum* Born × $\frac{1}{2}$, (inner view).
,, 4. *Plicatula australis* Lamarck, (inner view of attached valve).
,, 5*a*. *Pecten tranquebaricus* (Gmelin), (outer view).
,, 5*b*. *Pecten tranquebaricus* (Gmelin), (inner view).

PLATE VIII



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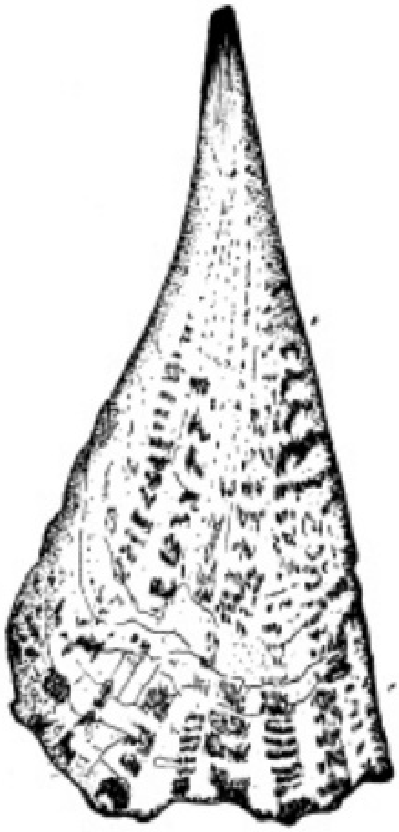

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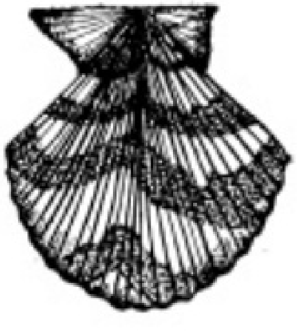

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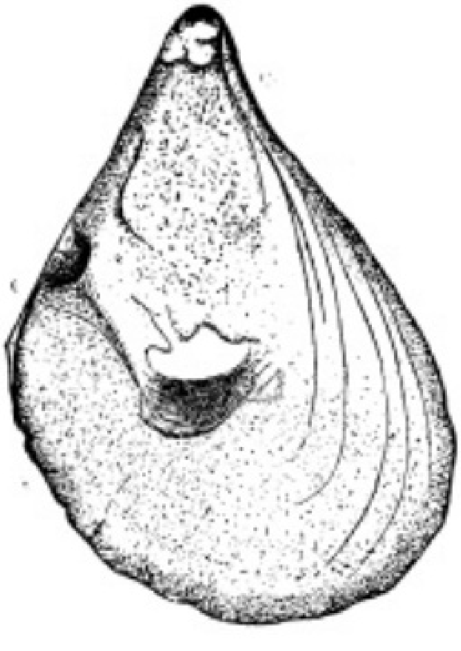

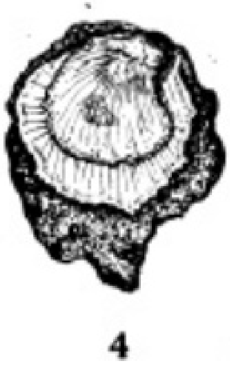

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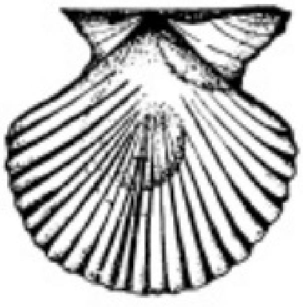
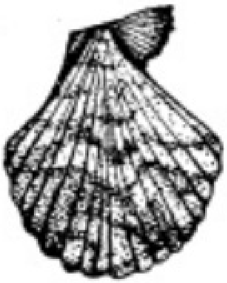


3

5b

PLATE IX.

Fig. 1*a*. *Pecten splendidulus* Sowerby, (outer view).
,, 1*b*. *Pecten splendidulus* Sowerby, (inner view).
,, 2*a*. *Pecten crassicostatus* Sowerby, (outer view).
,, 2*b*. *Pecten crassicostatus* Sowerby, (inner view).
,, 3*a*. *Pecten plica* (Linné), (outer view).
,, 3*b*. *Pecten plica* (Linné), (inner view).
,, 4*a*. *Spondylus layardi* Reeve, (outer view).
,, 4*b*. *Spondylus layardi* Reeve, (inner view).



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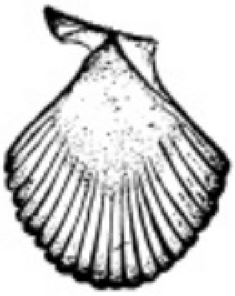

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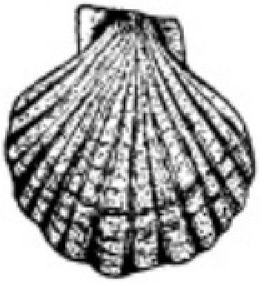

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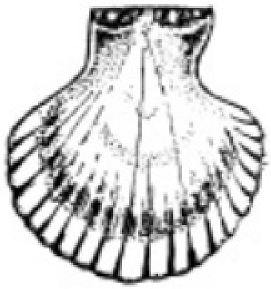

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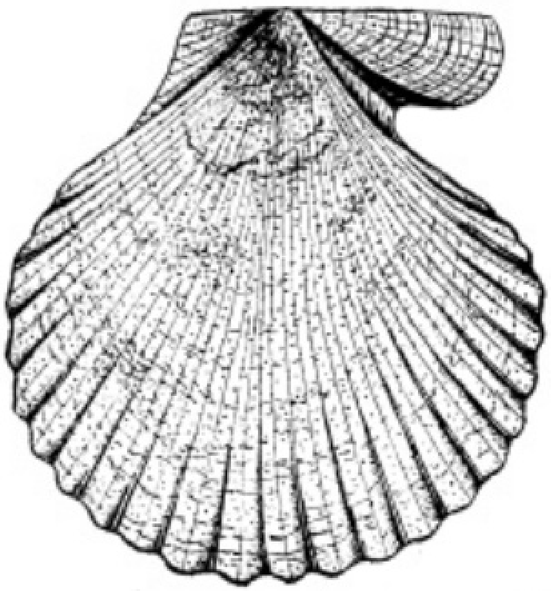

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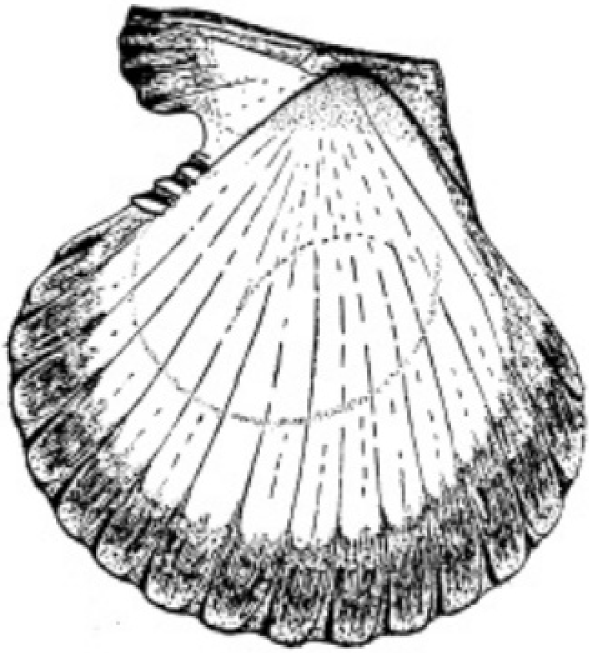

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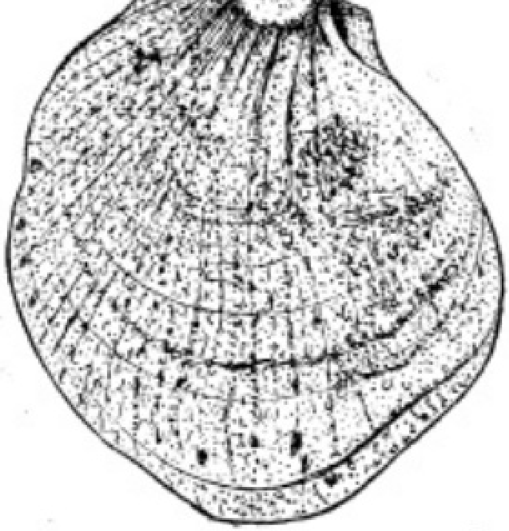

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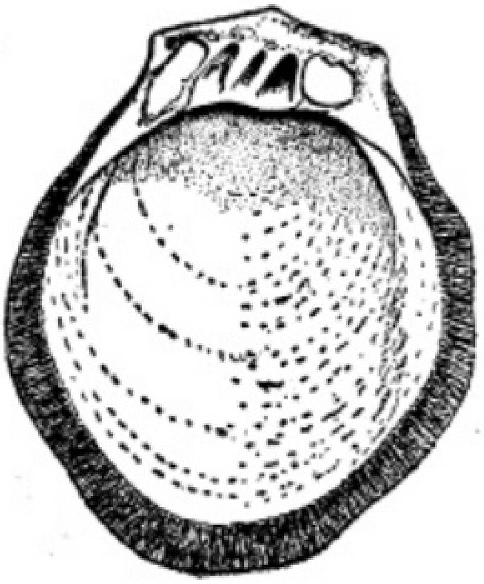
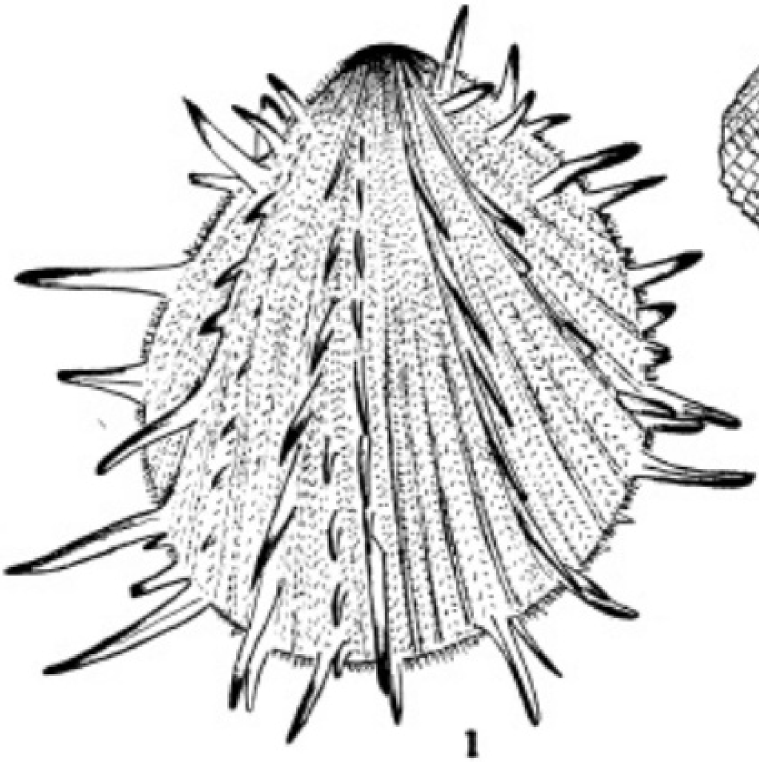


4b

M.K.I.—29

PLATE X.

Fig. 1. *Spondylus imperialis* Chenu, (outer view).
,, 2*a*. *Lima lima* (Linné), (outer view).
,, 2*b*. *Lima lima* (Linné), (inner view).
,, 3. *Placenta placenta* (Linné) × $\frac{1}{2}$, (inner view).
,, 4*a*. *Ostraea forskalii* Gmelin, (entire view of shell with both valves intact).
,, 4*b*. *Ostraea forskalii* Gmelin, (outer view of left valve).
,, 4*c*. *Ostraea forskalii* Gmelin, (inner view of left valve).
,, 4*d*. *Ostraea forskalii* Gmelin, (outer view of right valve).
,, 4*e*. *Ostraea forskalii* Gmelin, (inner view of right valve).



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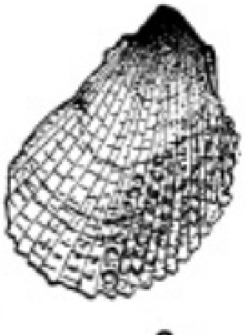

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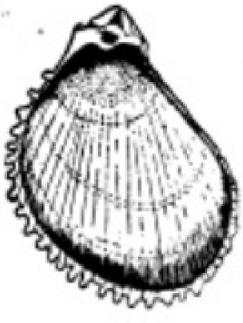

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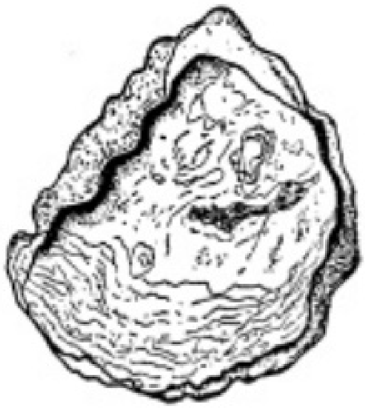

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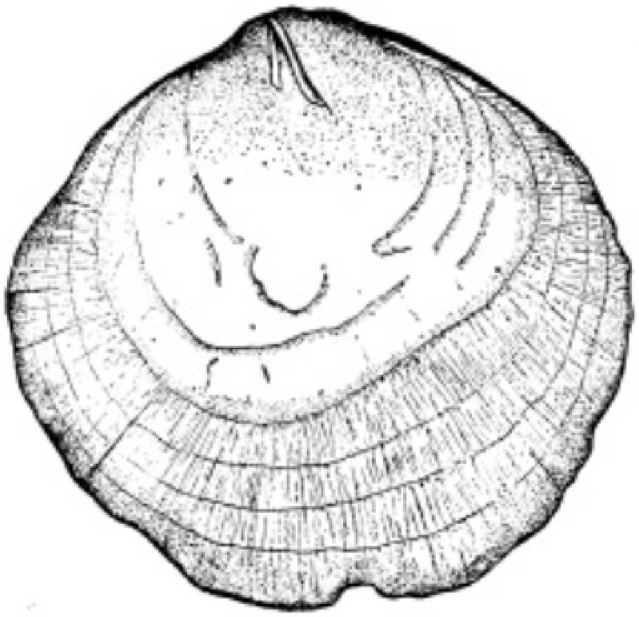

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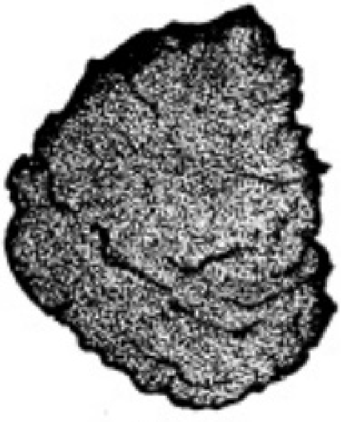

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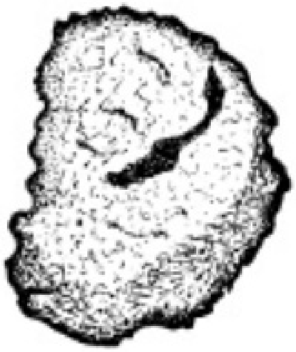

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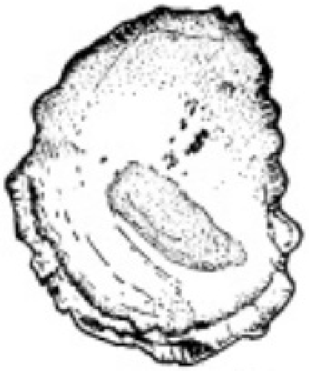

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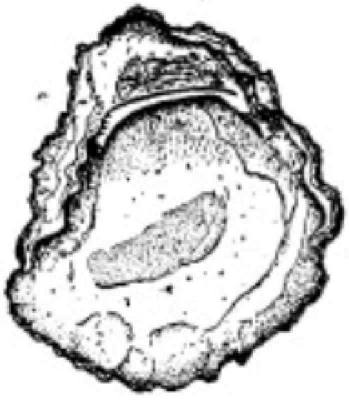
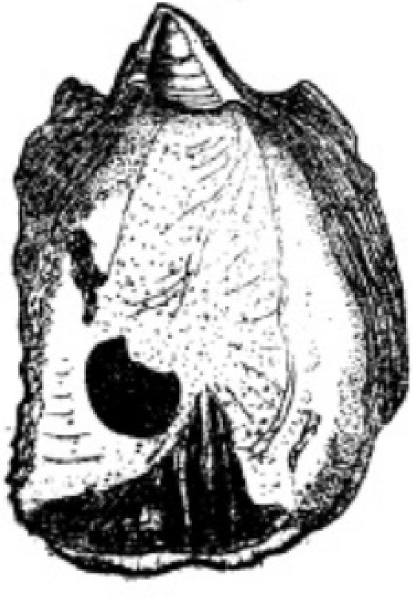


4c

PLATE XI.

Fig. 1. *Ostraea madrasensis* Preston, (inner view).
 „ 2*a*. *Ostraea crista-galli* (Linné), (outer view of both valves in closed position).
 „ 2*b*. *Ostraea crista-galli* (Linné), (inner view of single valve).
 „ 3. *Ostraea folium* Gmelin, (entire view of shell attached to a twig).
 „ 4*a*. *Crassatella rostrata* Lamarck, (outer view).
 „ 4*b*. *Crassatella rostrata* Lamarck, (inner view).
 „ 5*a*. *Cardita bicolor* Lamarck, (outer view).
 „ 5*b*. *Cardita bicolor* Lamarck, (inner view).
 „ 6*a*. *Beguina variegata* (Bruguière), (outer view).
 „ 6*b*. *Beguina variegata* (Bruguière), (inner view).
 „ 7*a*. *Beguina crassicosta* (Lamarck), (outer view).
 „ 7*b*. *Beguina crassicosta* (Lamarck), (inner view).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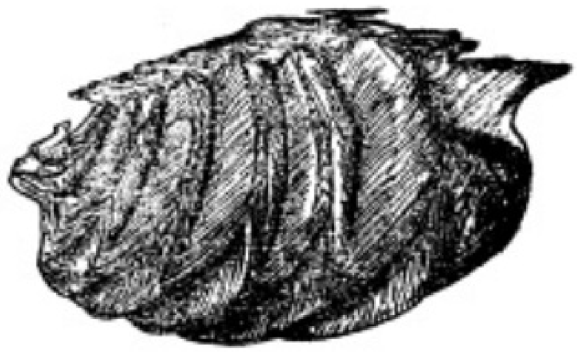
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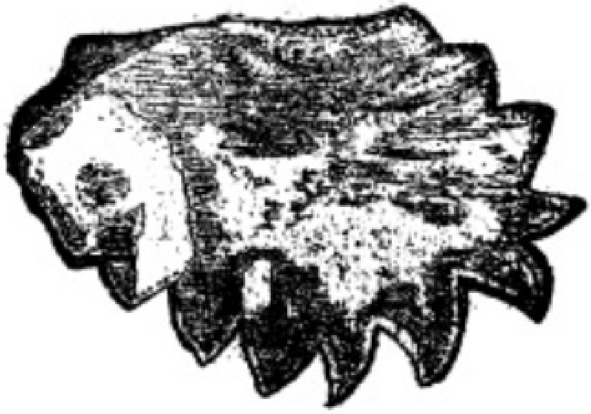
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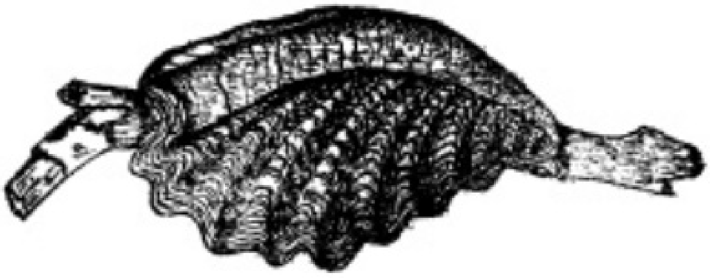
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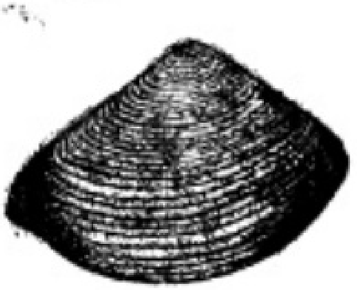
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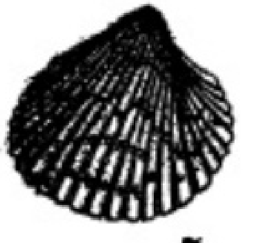
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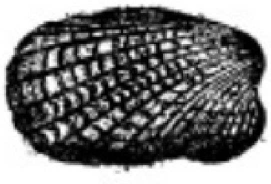
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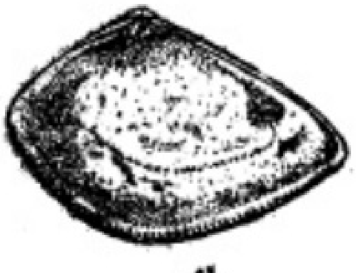
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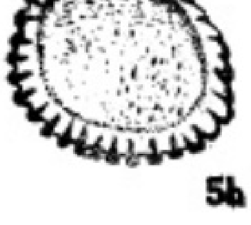
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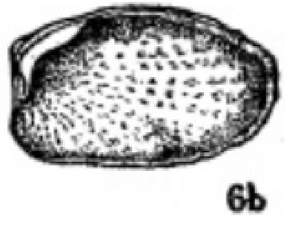
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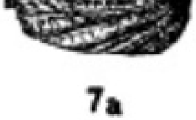
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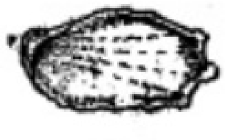
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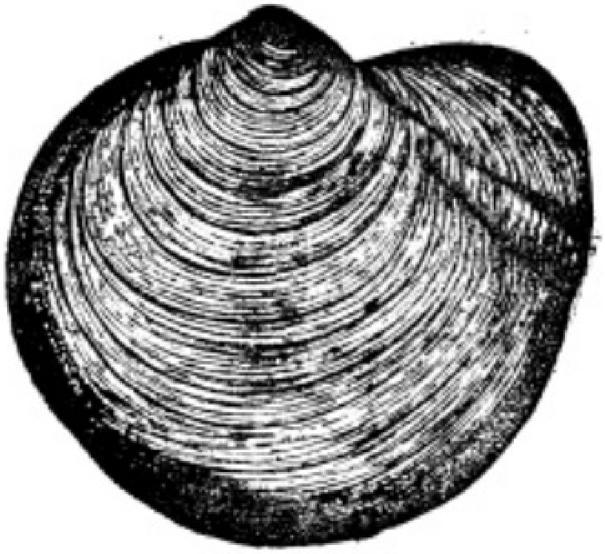
PLATE XII.

Fig. 1*a*. *Lucina edentula* (Linné), (outer view).
„ 1*b*. *Lucina edentula* (Linné), (inner view).
„ 2*a*. *Lucina ovum* Reeve, (outer view).
„ 2*b*. *Lucina ovum* Reeve, (inner view).
„ 3*a*. *Lucina pisum* Reeve × 1½, (outer view).
„ 3*b*. *Lucina pisum* Reeve × 1½, (inner view).
„ 4. *Lucina vesicula* Gould × 2, spirit specimen, (outer view).
„ 5*a*. *Divaricella cumingii* (A. Adams & Angas), (outer view).
„ 5*b*. *Divaricella cumingii* (A. Adams & Angas), (inner view).
„ 6*a*. *Codakia angela* (Melvill) × 2, (outer view).
„ 6*b*. *Codakia angela* (Melvill) × 2, (inner view).
„ 7*a*. *Codakia divergens* (Philippi), (outer view).
„ 7*b*. *Codakia divergens* (Philippi), (inner view).
„ 8*a*. *Corbis sowerbyi* Reeve, (outer view).
„ 8*b*. *Corbis sowerbyi* Reeve, (inner view).
„ 9. *Galeomma paucistriata* Deshayes, spirit specimen, (outer view).
„ 10. *Scintilla hanleyi* Deshayes, spirit specimen, contracted, (outer view).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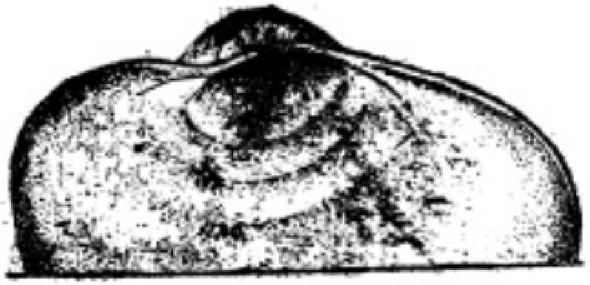
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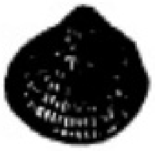
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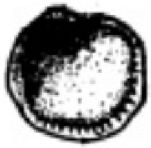
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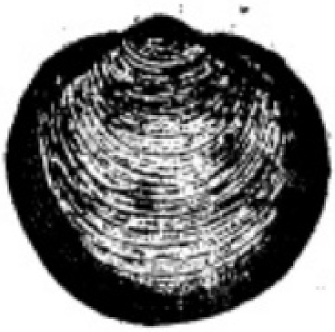
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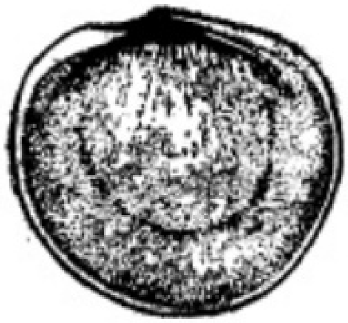
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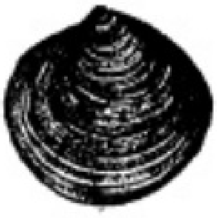
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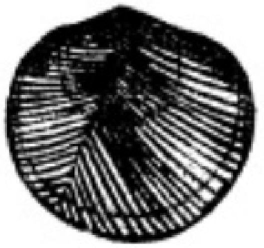
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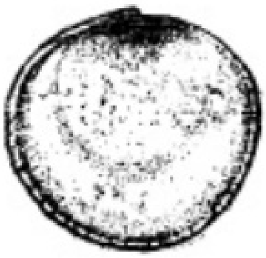
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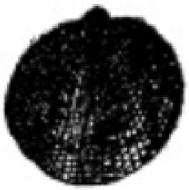
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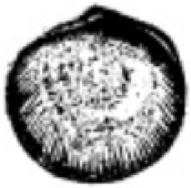
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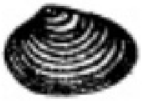
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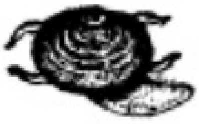
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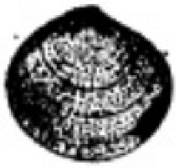
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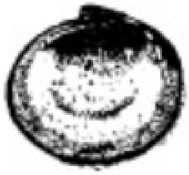
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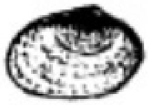
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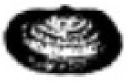
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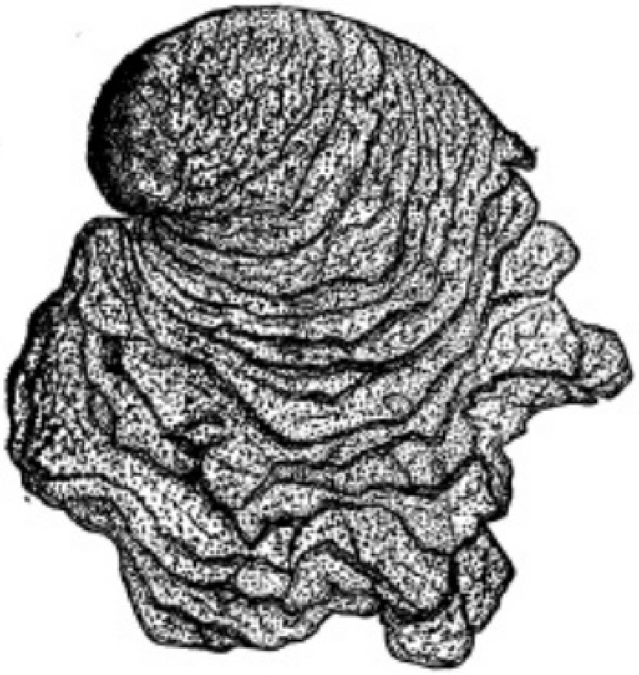
PLATE XIII.

Fig. 1*a*. *Chama reflexa* Reeve, (outer view).
„ 1*b*. *Chama reflexa* Reeve, (inner view).
„ 2*a*. *Chama lazarus* Linné, (outer view).
„ 2*b*. *Chama lazarus* Linné, (inner view).
„ 3*a*. *Chama fragum* Reeve, (outer view).
„ 3*b*. *Chama fragum* Reeve, (inner view).
„ 4*a*. *Pseudochama cristella* (Lamarck), (outer view).
„ 4*b*. *Pseudochama cristella* (Lamarck), (inner view).

PLATE XIII



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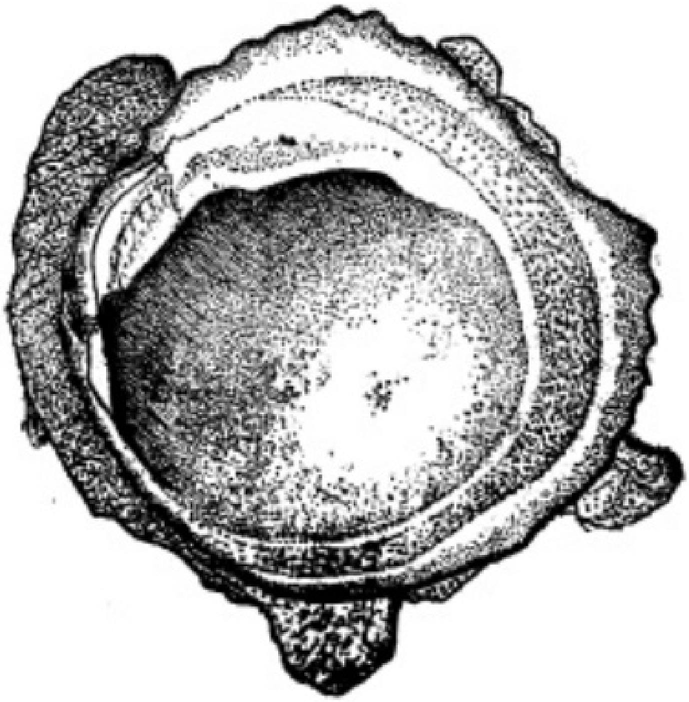

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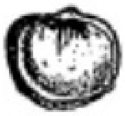

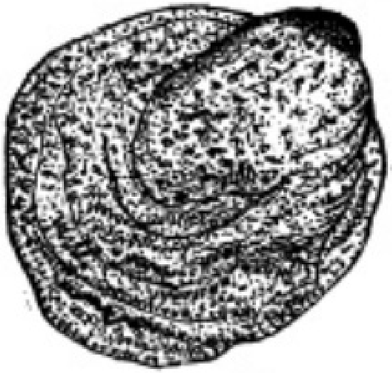

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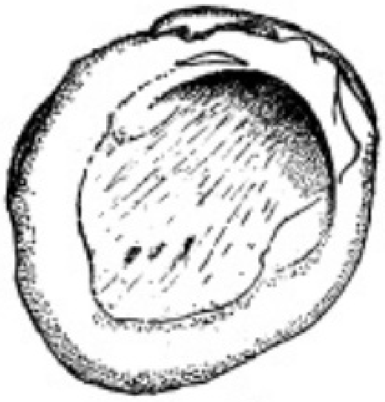

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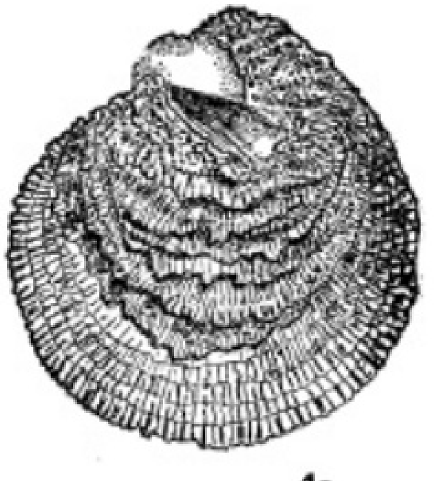

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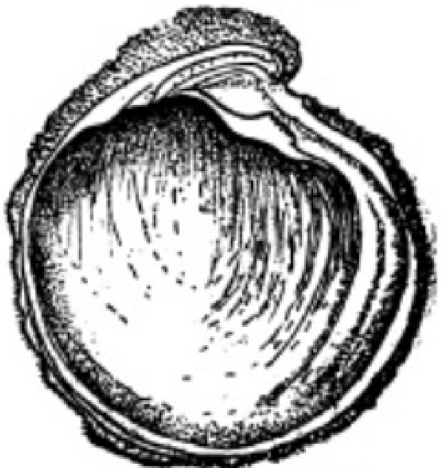


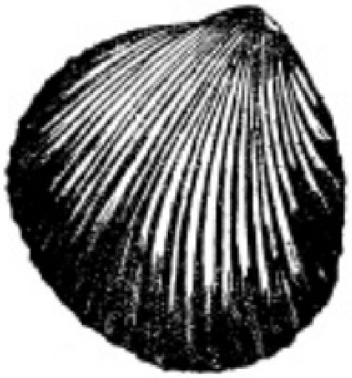
2a

2b

4b

PLATE XIV.

Fig. 1*a*. *Cardium flavum* Linné, (outer view).
,, 1*b*. *Cardium flavum* Linné, (inner view).
,, 1*c*. *Cardium flavum* Linné (dorsal view).
,, 2*a*. *Cardium asiaticum* Bruguière, (outer view).
,, 2*b*. *Cardium asiaticum* Bruguière, (inner view).
,, 3*a*. *Cardium setosum* Redfern, (outer view).
,, 3*b*. *Cardium setosum* Redfern, (inner view).
,, 4*a*. *Cardium assimile* Reeve, (outer view).
,, 4*b*. *Cardium assimile* Reeve, (inner view).
,, 5. *Cardium australe* Sowerby, (outer view).
,, 6*a*. *Cardium papyracea* Chemnitz, (outer view).
,, 6*b*. *Cardium papyracea* Chemnitz, (inner view).
,, 7*a*. *Lunulicardia retusa* (Linné), (outer view).
,, 7*b*. *Lunulicardia retusa* (Linné), (inner view).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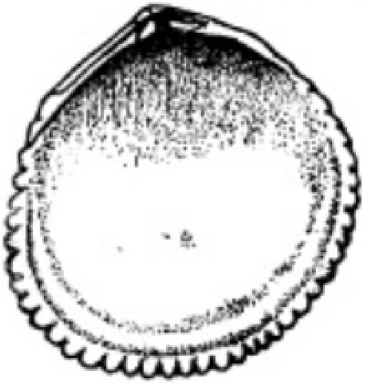
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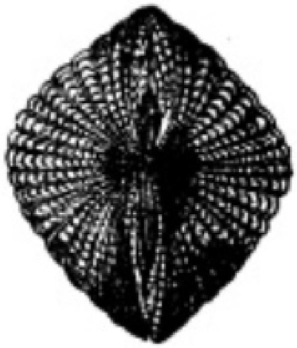
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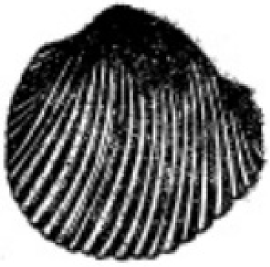
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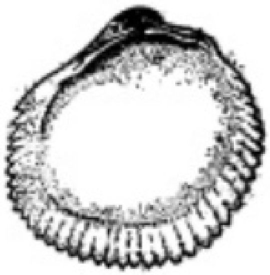
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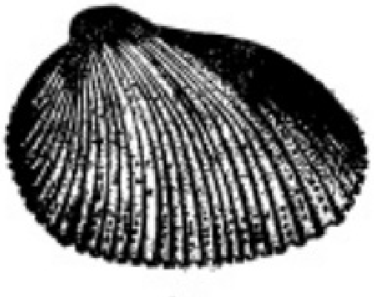
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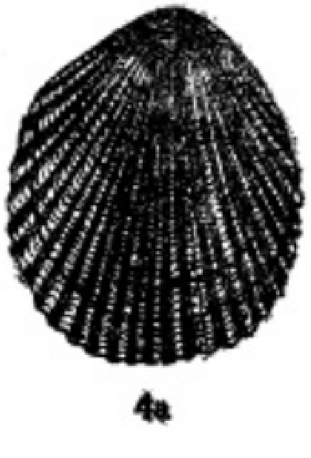
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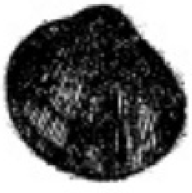
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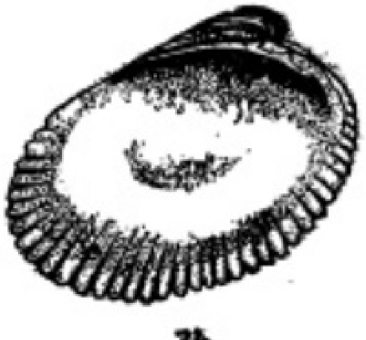
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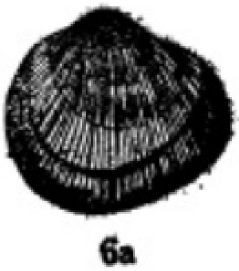
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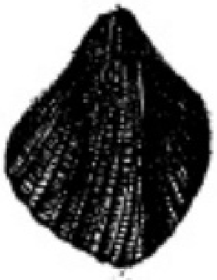
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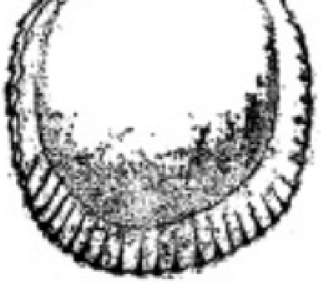
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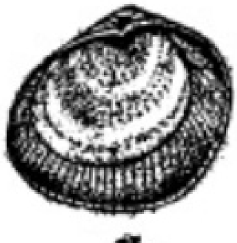
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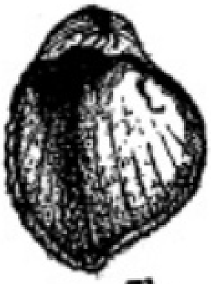
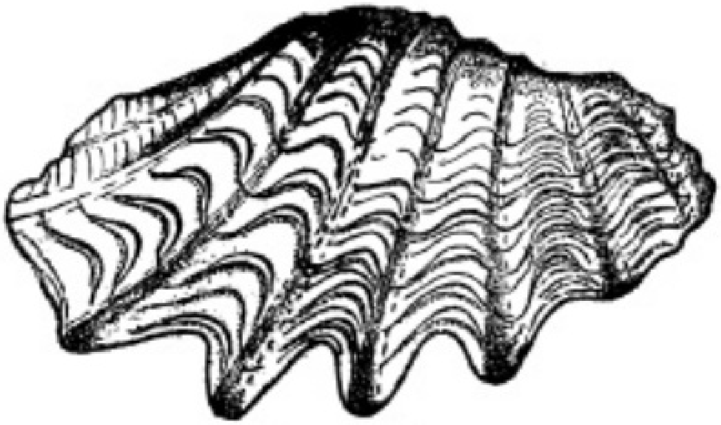

7b

M.K.I.—30A

PLATE XV.

Fig. 1*a*. *Tridacna elongata* Lamarck, young shell, (outer view).
„ 1*b*. *Tridacna elongata* Lamarck, young shell, (inner view).
„ 2*a*. *Circe scripta* (Linné), (outer view).
„ 2*b*. *Circe scripta* (Linné), (inner view).
„ 3*a*. *Gafrarium tumidum* Röding, (outer view).
„ 3*b*. *Gafrarium tumidum* Röding, (inner view).
„ 4*a*. *Gafrarium pectinatum* (Linné), (outer view).
„ 4*b*. *Gafrarium pectinatum* (Linné), (inner view).
„ 5*a*. *Gafrarium dispar* (Chemnitz), (outer view).
„ 5*b*. *Gafrarium dispar* (Chemnitz), (inner view).



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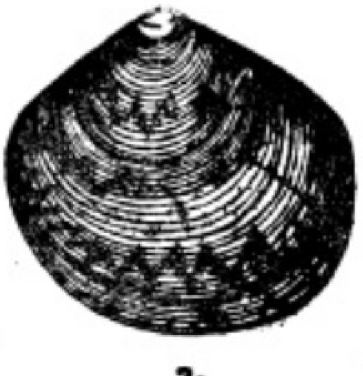

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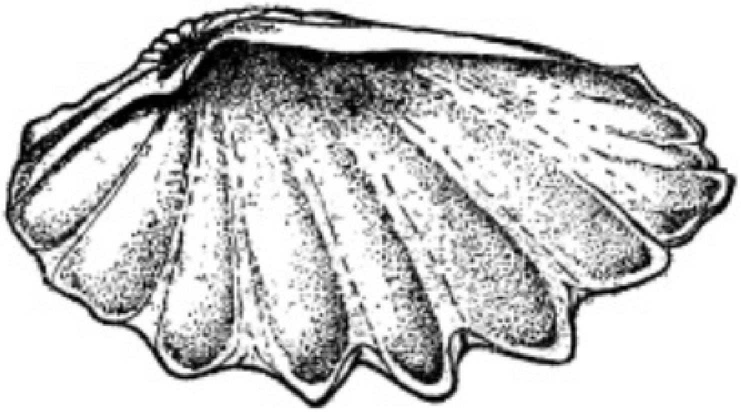

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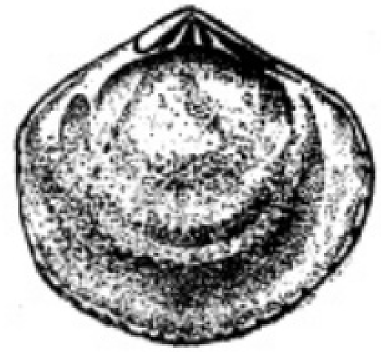

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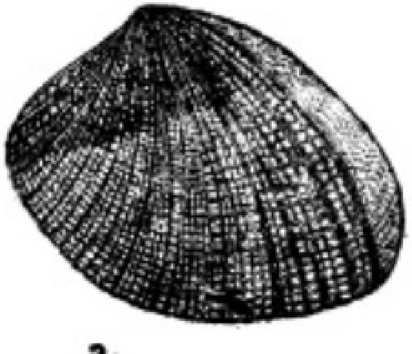

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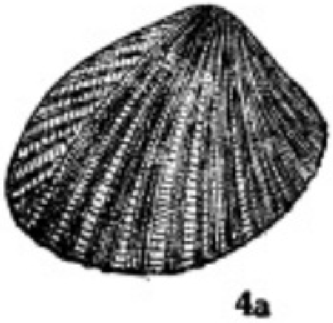

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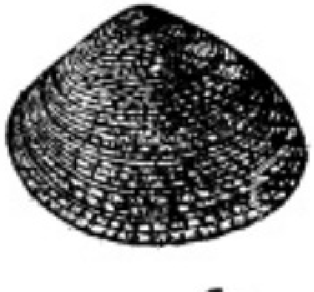

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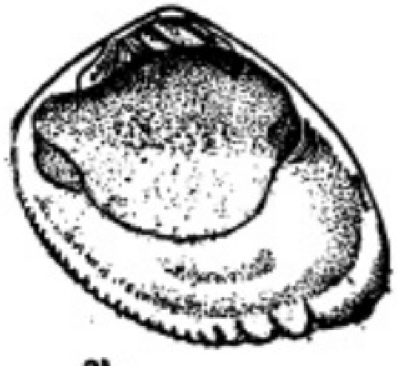

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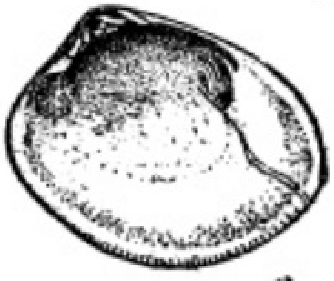

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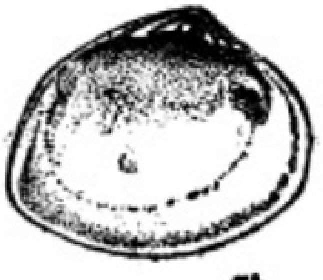
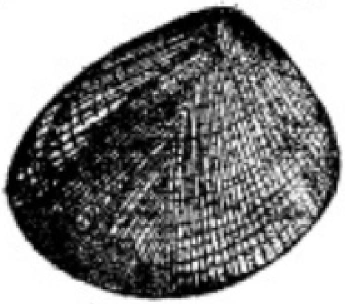


5b

PLATE XVI.

Fig. 1*a*. *Gafrarium divaricata* (Chemnitz), (outer view).
,, 1*b*. *Gafrarium divaricata* (Chemnitz), (inner view).
,, 2*a*. *Meretrix casta* (Chemnitz), (outer view).
,, 2*b*. *Meretrix casta* (Chemnitz), (inner view).
,, 3. *Pitar alabastrum* (Reeve), (outer view).
,, 4*a*. *Pitar erycina* (Linné), (outer view).
,, 4*b*. *Pitar erycina* (Linné), (inner view).



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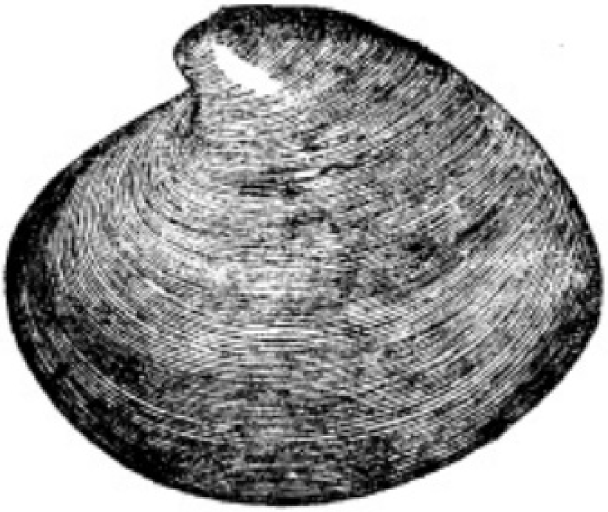

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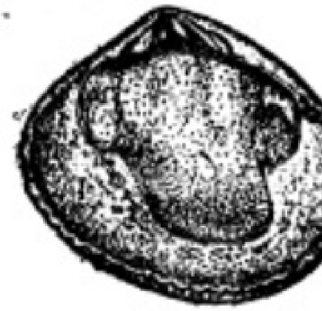

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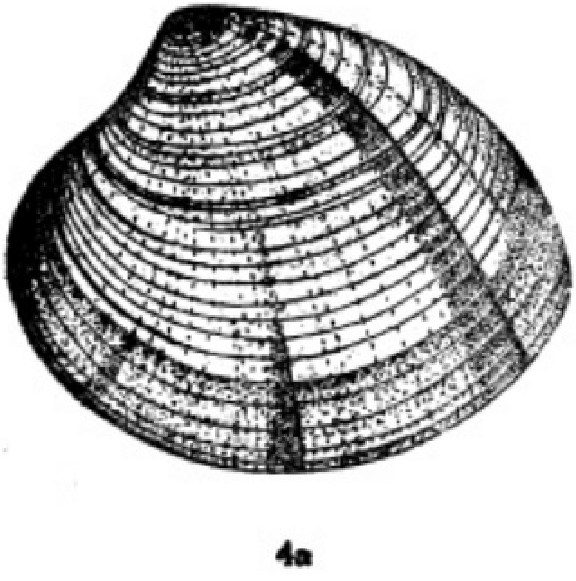

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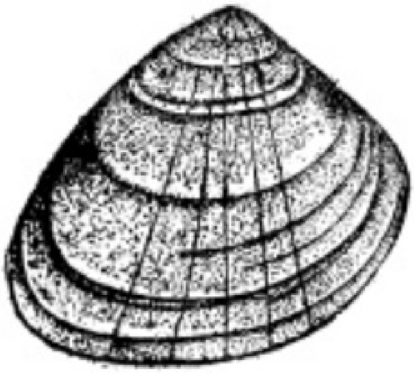

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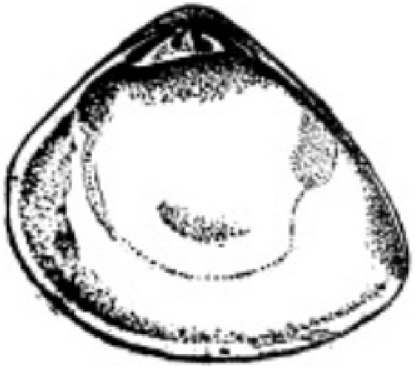

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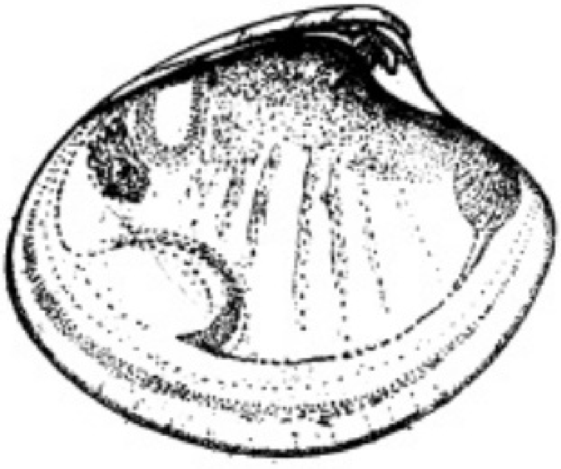
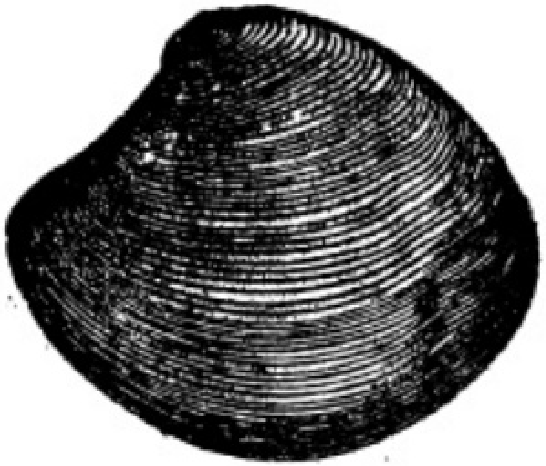


4b

PLATE XVII.

Fig. 1*a*. *Pitar nobilis* (Reeve), (outer view).
" 1*b*. *Pitar nobilis* (Reeve), (hinge view).
" 2*a*. *Sunetta scripta* (Linné), (outer view).
" 2*b*. *Sunetta scripta* (Linné), (inner view).
" 3. *Dosinia histrio* (Gmelin), (outer view).
" 4*a*. *Dosinia modesta* (Sowerby), (outer view).
" 4*b*. *Dosinia modesta* (Sowerby), (inner view).
" 5*a*. *Dosinia cretacea* (Reeve), (outer view).
" 5*b*. *Dosinia cretacea* (Reeve), (inner view).
" 6*a*. *Dosinia trigona* (Reeve), (outer view).
" 6*b*. *Dosinia trigona* (Reeve), (inner view).
" 7*a*. *Dosinia puella* Angas × 2, (outer view).
" 7*b*. *Dosinia puella* Angas × 2, (inner view).



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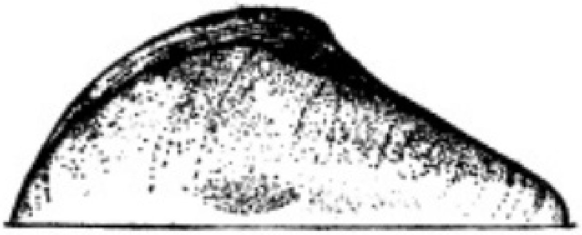

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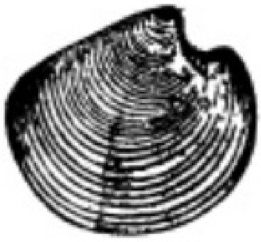

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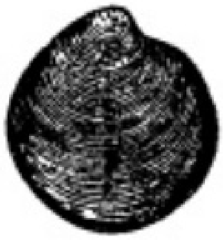

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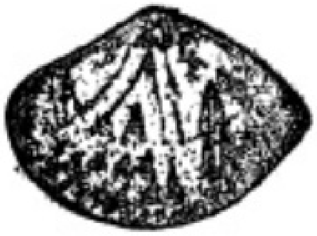

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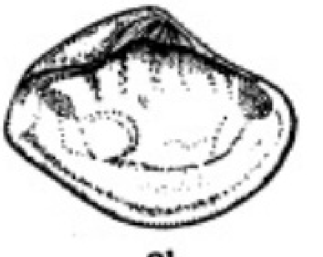

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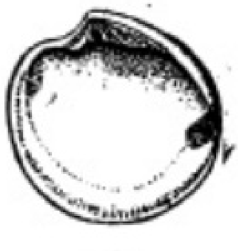

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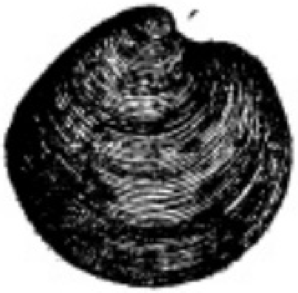

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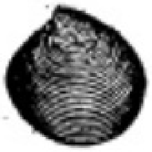

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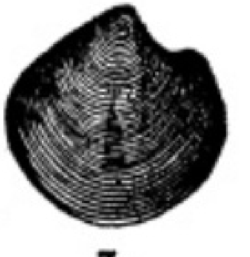
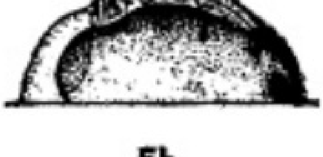


7a



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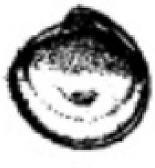

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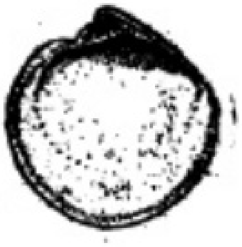
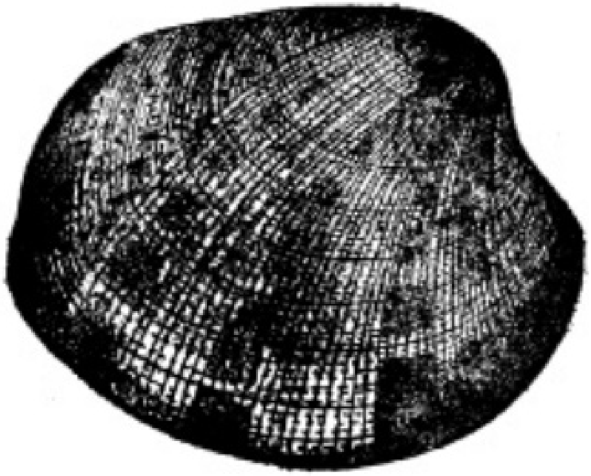


7b

PLATE XVIII.

Fig. 1*a*. *Venus reticulata* Linné, (outer view).
„ 1*b*. *Venus reticulata* Linné, (hinge view).
„ 2*a*. *Venus chemnitzii* Hanley, (outer view).
„ 2*b*. *Venus chemnitzii* Hanley, (hinge view).
„ 3. *Venus arakana* (G. & H. Nevill) × 2, (outer view).
„ 4*a*. *Venus imbricata* Sowerby × 2, (outer view).
„ 4*b*. *Venus imbricata* Sowerby × 2, (inner view).
„ 5*a*. *Antigona lamellaris* Schumacher, (outer view).
„ 5*b*. *Antigona lamellaris* Schumacher, (inner view).

PLATE XVIII



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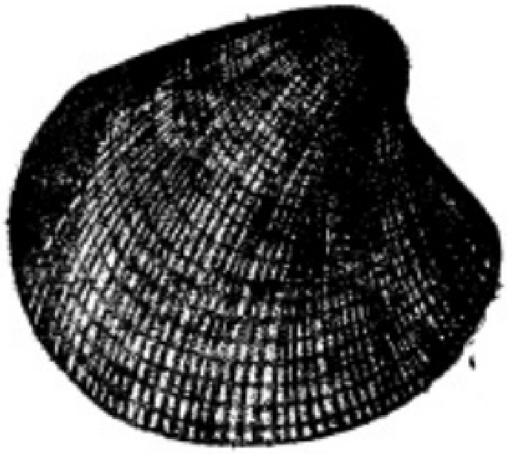

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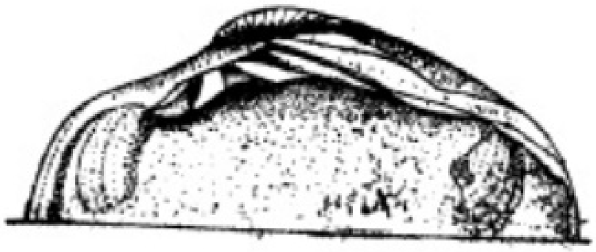

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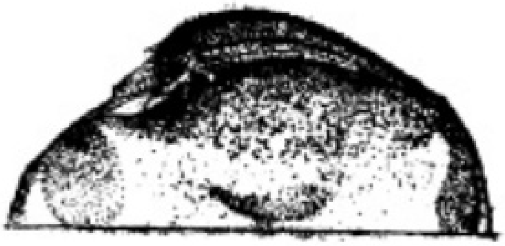

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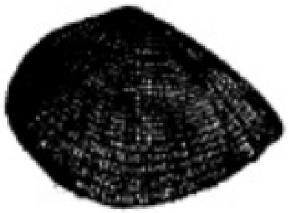

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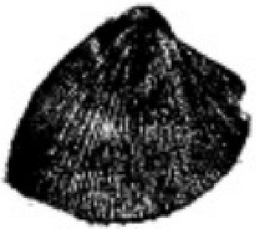

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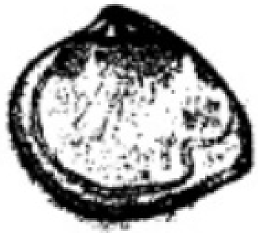

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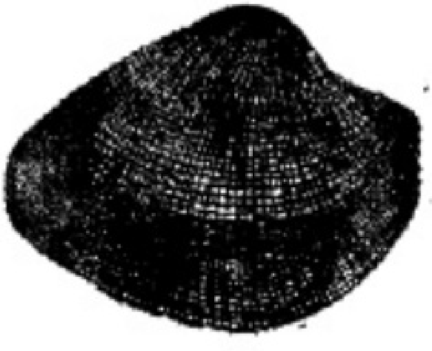

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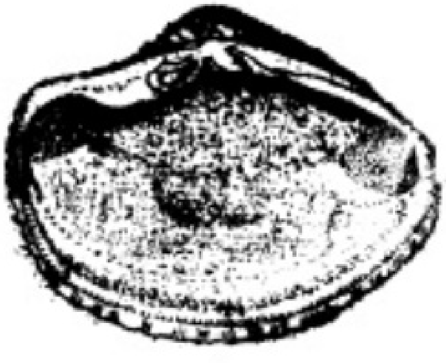
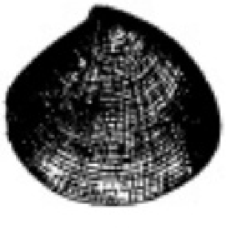


5b

PLATE XIX.

Fig. 1*a*. *Chione scabra* (Hanley) × 2, (outer view).
,, 1*b*. *Chione scabra* (Hanley) × 2, (inner view).
,, 2*a*. *Chione tiara* (Dillwyn), (outer view).
,, 2*b*. *Chione tiara* (Dillwyn), (inner view).
,, 3*a*. *Chione calophylla* (Philippi), (outer view).
,, 3*b*. *Chione calophylla* (Philippi), (inner view).
,, 4*a*. *Periglypta fischeri* (Récluz), spirit specimen, (outer view).
,, 4*b*. *Periglypta fischeri* (Récluz), (dorsal view of the same).
,, 4*c*. *Periglypta fischeri* (Récluz), dry specimen, (hinge view).
,, 5*a*. *Venerupis macrophylla* Deshayes, (outer view).
,, 5*b*. *Venerupis macrophylla* Deshayes, (inner view).
,, 6*a*. *Catelysia opima* (Gmelin), (outer view).
,, 6*b*. *Catelysia opima* (Gmelin), (inner view).
,, 6*c*. *Catelysia opima* (Gmelin), (dorsal view of both the valves intact).



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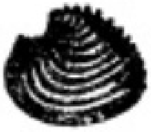

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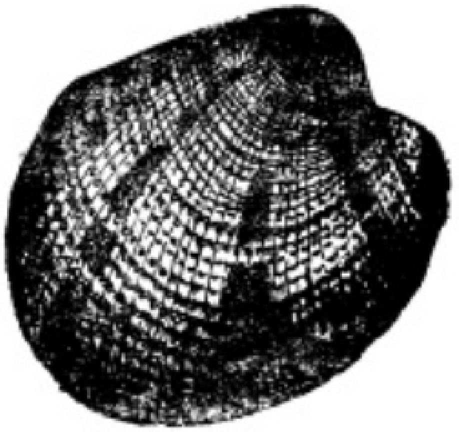

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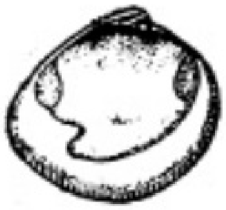

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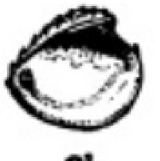

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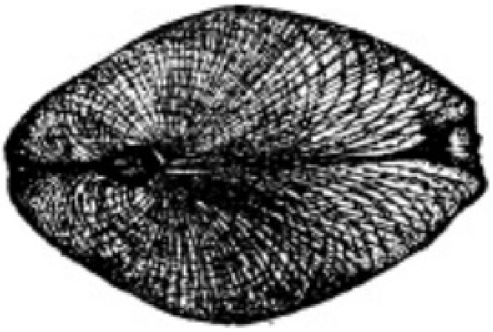

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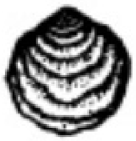

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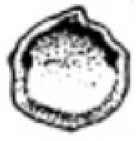

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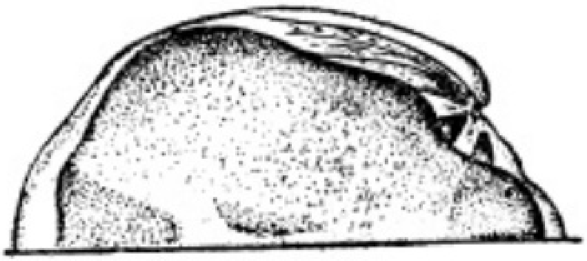

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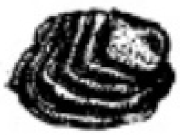

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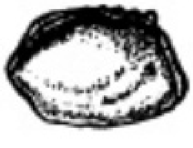

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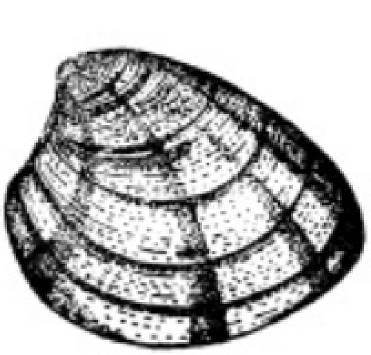

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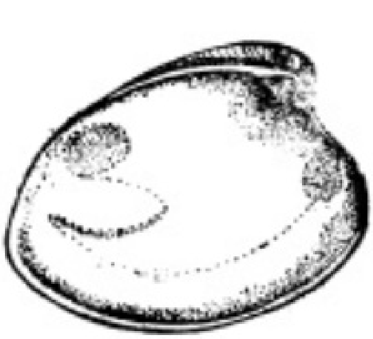

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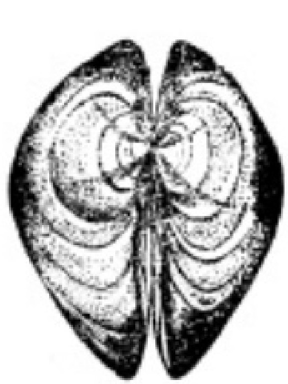
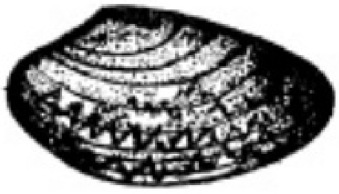


6c

PLATE XX.

Fig. 1*a*. *Paphia textile* (Gmelin), (outer view).
,, 1*b*. *Paphia textile* (Gmelin), (hinge view).
,, 2. *Paphia ala-papiliones* Röding, (outer view).
,, 3*a*. *Paphia malabarica* (Chemnitz), (outer view).
,, 3*b*. *Paphia malabarica* (Chemnitz), (hinge view).
,, 4*a*. *Tapes radiatus* (Chemnitz), (outer view).
,, 4*b*. *Tapes radiatus* (Chemnitz) hinge view).
,, 5*a*. *Tapes philippinarum* (Adams & Reeve), (outer view).
,, 5*b*. *Tapes philippinarum* (Adams & Reeve), inner view).
,, 6. *Irus exoticus* (Lamarck), spirit specimen, (outer view).
,, 7*a*. *Petricola divergens* (Gmelin), (outer view).
,, 7*b*. *Petricola divergens* (Gmelin), (inner view).
,, 8*a*. *Petricola lithophaga* (Retzius), (outer view).
,, 8*b*. *Petricola lithophaga* (Retzius), (inner view).
,, 9*a*. *Mesodesma glabratum* (Lamarck), (outer view).
,, 9*b*. *Mesodesma glabratum* (Lamarck), (inner view).



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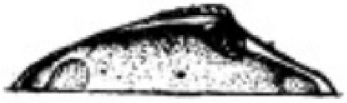

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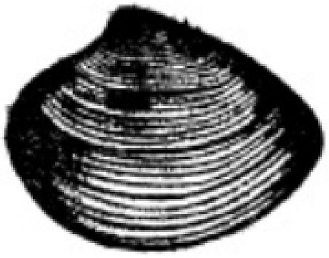

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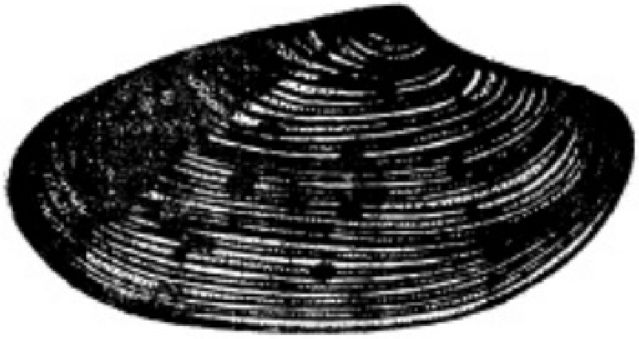

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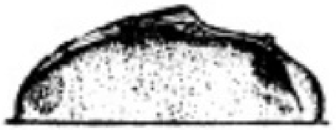

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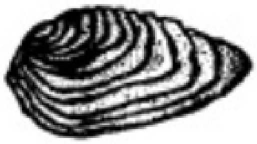

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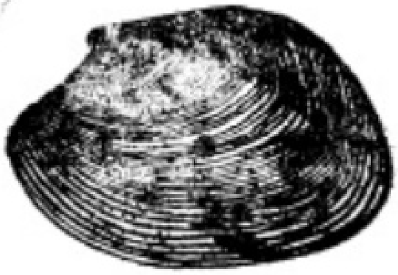

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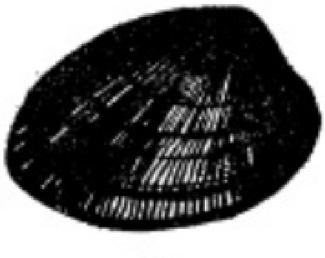

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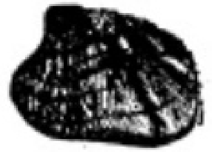
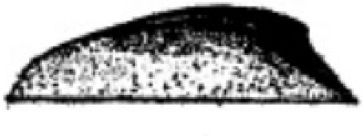


7a



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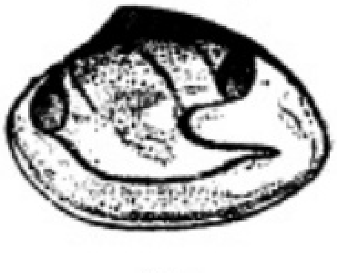

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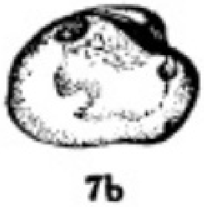

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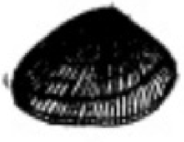

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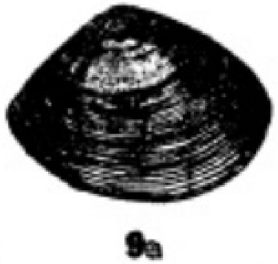
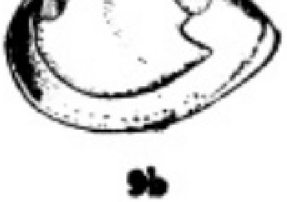


9a



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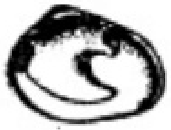
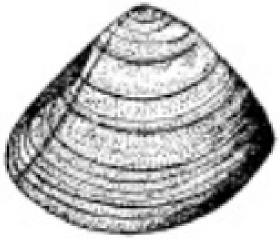


8b

PLATE XXI.

Fig. 1*a*. ***Mesodesma trigona*** Deshayes, (outer view).
" 1*b*. ***Mesodesma trigona*** Deshayes, (hinge view).
" 2*a*. ***Mactra cuneata*** Chemnitz, (outer view).
" 2*b*. ***Mactra cuneata*** Chemnitz, (inner view).
" 3*a*. ***Mactra turgida*** Gmelin, (outer view).
" 3*b*. ***Mactra turgida*** Gmelin, (hinge view).
" 4*a*. ***Mactra mera*** Reeve, (outer view).
" 4*b*. ***Mactra mera*** Reeve, (inner view).
" 5*a*. ***Mactra violacea*** Chemnitz, (outer view).
" 5*b*. ***Mactra violacea*** Chemnitz, (hinge view).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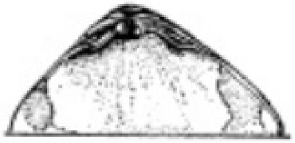
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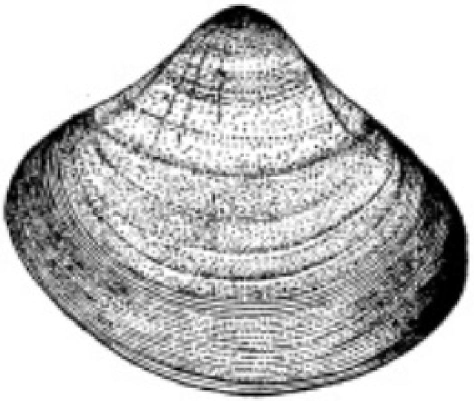
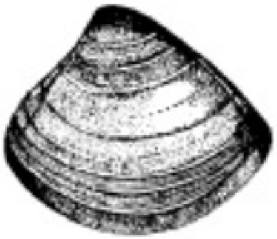

3a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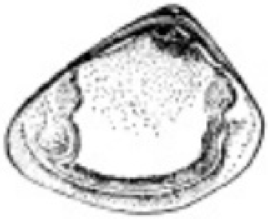
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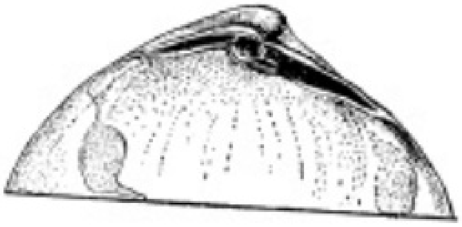
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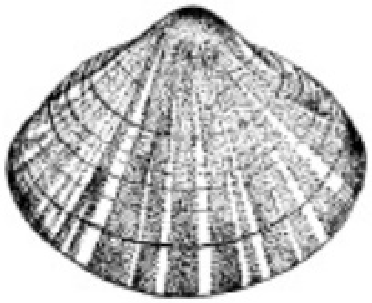
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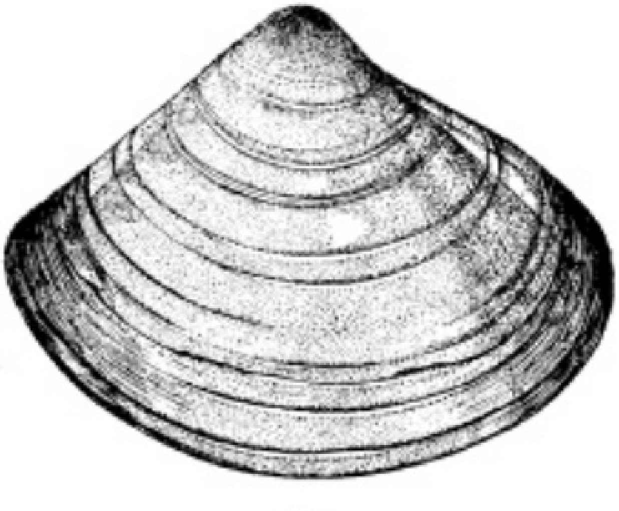
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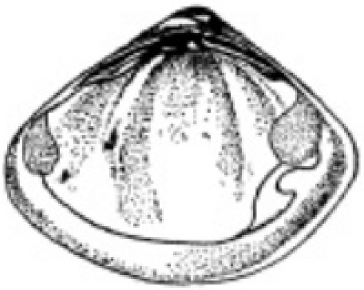
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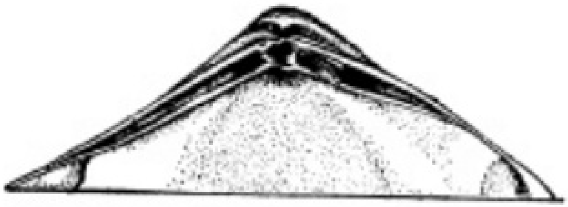
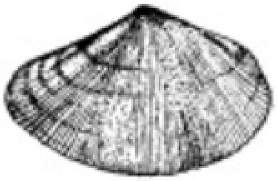

5b

PLATE XXII.

Fig. 1*a*. *Standella nicobarica* (Gmelin), (outer view).
,, 1*b*. *Standella nicobarica* (Gmelin), (inner view).
,, 2*a*. *Donax cuneatus* Linné, (outer view).
,, 2*b*. *Donax cuneatus* Linné, (inner view).
,, 3*a*. *Donax scortum* Linné, (outer view).
,, 3*b*. *Donax scortum* Linné, (inner view).
,, 4*a*. *Donax faba* Gmelin, (outer view).
,, 4*b*. *Donax faba* Gmelin, (inner view).
,, 4*c*. *Donax faba* Gmelin, (dorsal view).
,, 5. *Donax lubrica* Hanley, (outer view).
,, 6*a*. *Donax incarnatus* Chemnitz, (outer view).
,, 6*b*. *Donax incarnatus* Chemnitz, (inner view).
,, 6*c*. *Donax incarnatus* Chemnitz, young shell, (mislabelled *D. dysoni* Deshayes), × 1½, (outer view).
,, 6*d*. *Donax incarnatus* Chemnitz × 1½, (inner view of the above).
,, 7*a*. *Donax spinosus* Gmelin, (outer view).
,, 7*b*. *Donax spinosus* Gmelin, (inner view).
,, 8. *Donax aperittus* Melvill, (outer view).
,, 9*a*. *Semele crenulata* (Sowerby), (outer view).
,, 9*b*. *Semele crenulata* (Sowerby), (inner view).
,, 10*a*. *Semele casta* A. Adams, (outer view).
,, 10*b*. *Semele casta* A. Adams, (inner view).
,, 11*a*. *Semele striata* (Rüppell), (outer view).
,, 11*b*. *Semele striata* (Rüppell), (inner view).



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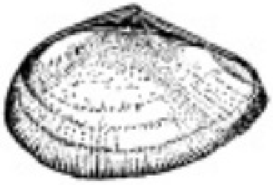

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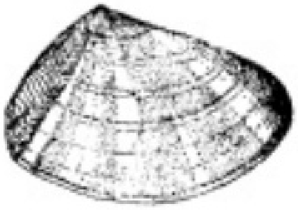

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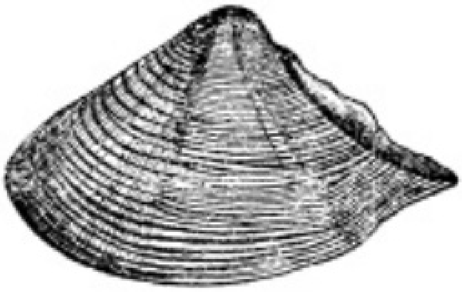

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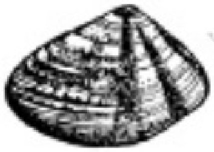

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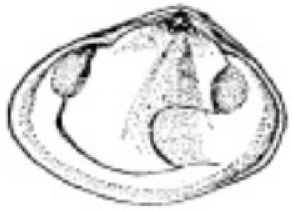

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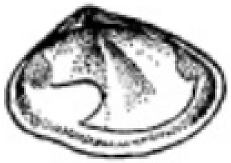

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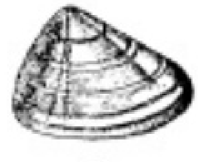

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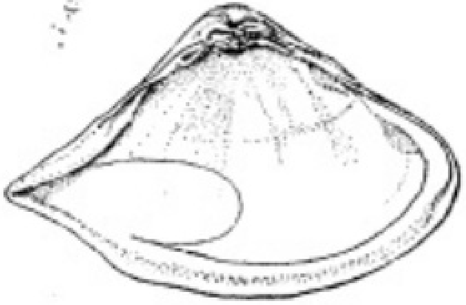

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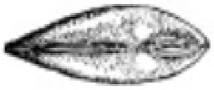

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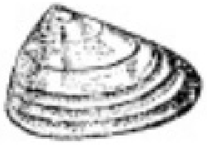

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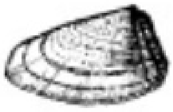

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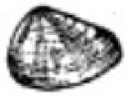

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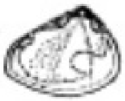

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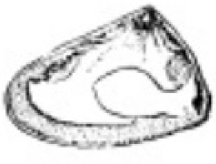

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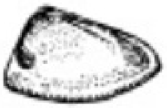

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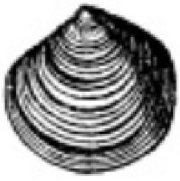

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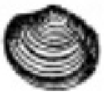

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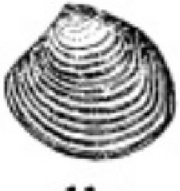

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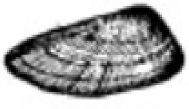

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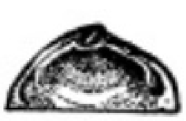

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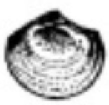

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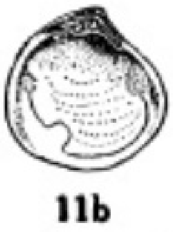
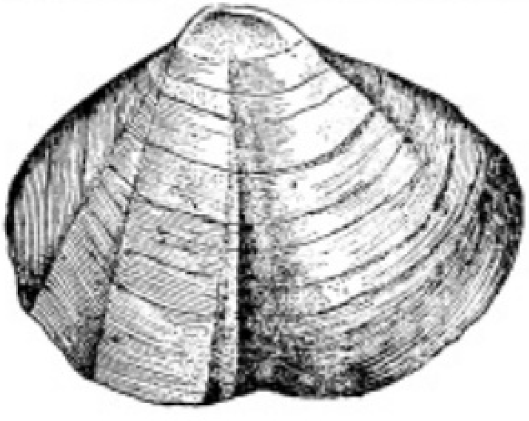


11b

PLATE XXIII.

Fig. 1*a*. *Tellina coarctata* Philippi, (outer view).
„ 1*b*. *Tellina coarctata* Philippi, (hinge view).
„ 2*a*. *Tellina angulata* Gmelin, (outer view).
„ 2*b*. *Tellina angulata* Gmelin, (hinge view).
„ 3*a*. *Tellina ala* Hanley, (outer view).
„ 3*b*. *Tellina ala* Hanley, (inner view).
„ 4*a*. *Tellina bruguièri* Hanley, (outer view).
„ 4*b*. *Tellina bruguièri* Hanley, (inner view).
„ 5. *Tellina scalpellum* Hanley × 2, (outer view).



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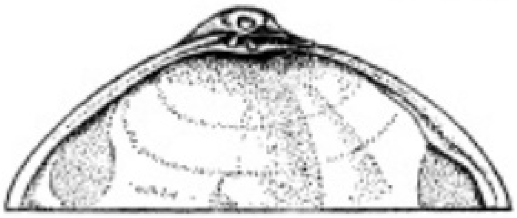

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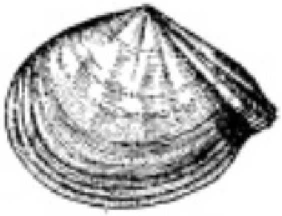

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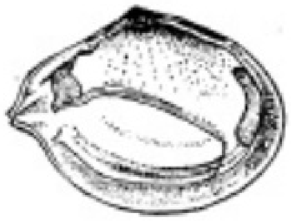

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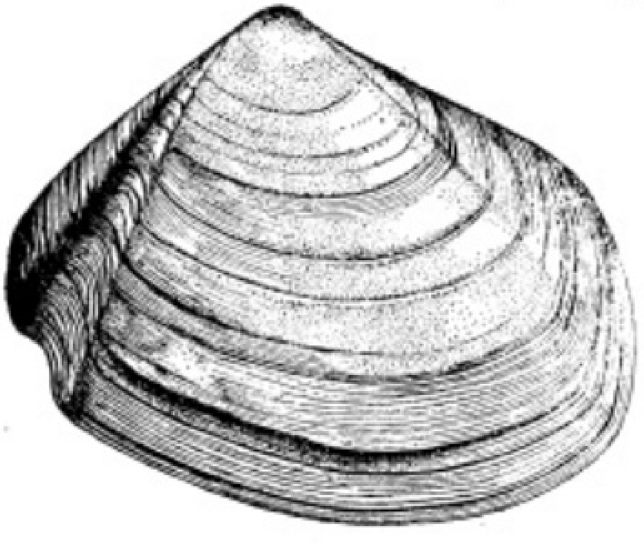

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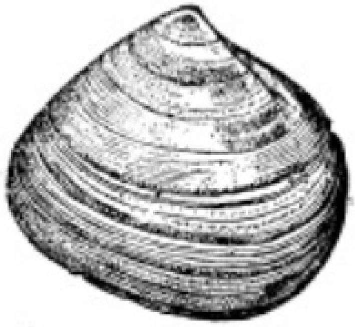

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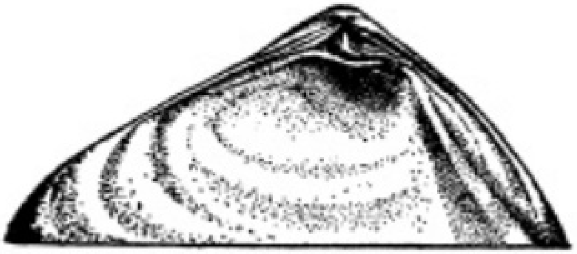

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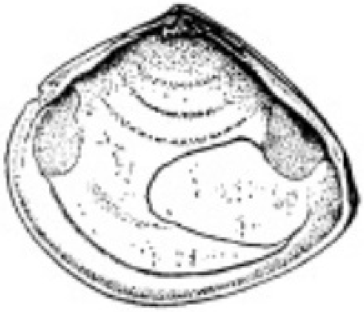
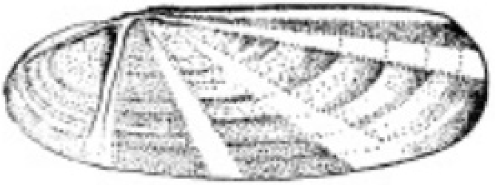


4b

PLATE XXIV.

Fig. 1*a*. *Siliqua radiata* (Linné), (inner view).
„ 1*b*. *Siliqua radiata* (Linné), (outer view).
„ 2. *Solen lamarckii* Deshayes, (outer view).
„ 3*a*. *Solen aspersus* Dunker, (outer view).
„ 3*b*. *Solen aspersus* Dunker, (inner view).
„ 4*a*. *Aloides modesta* (Hinds), (outer view).
„ 4*b*. *Aloides modesta* (Hinds), (inner view).
„ 5*a*. *Aloides sulculosa* (H. Adams) × 2, (outer view).
„ 5*b*. *Aloides sulculosa* (H. Adams) × 2, (inner view).
„ 6*a*. *Gastrochaena gigantea* (Deshayes), dry specimen, (outer view).
„ 6*b*. *Gastrochaena gigantea* (Deshayes), dry specimen, (inner view).
„ 7*a*. *Gastrochaena apertissima* Deshayes, dry specimen, (outer view).
„ 7*b*. *Gastrochaena apertissima* Deshayes, dry specimen, (inner view).
„ 7*c*. *Gastrochaena apertissima* Deshayes, spirit specimen, (dorsal view).
„ 7*d*. *Gastrochaena apertissima* Deshayes, spirit specimen, (ventral view).
„ 8*a*. *Gastrochaena lamellosa* Deshayes, spirit specimen, (dorsal view).
„ 8*b*. *Gastrochaena lamellosa* Deshayes, spirit specimen, (ventral view).
„ 9*a*. *Gastrochaena indistincta* Deshayes, spirit specimen, (dorsal view).
„ 9*b*. *Gastrochaena indistincta* Deshayes, spirit specimen, (ventral view).
„ 10*a*. *Gastrochaena impressa* Deshayes, dry specimen, (outer view).
„ 10*b*. *Gastrochaena impressa* Deshayes, spirit specimen, (dorsal view).
„ 10*c*. *Gastrochaena impressa* Deshayes, spirit specimen, (ventral view).



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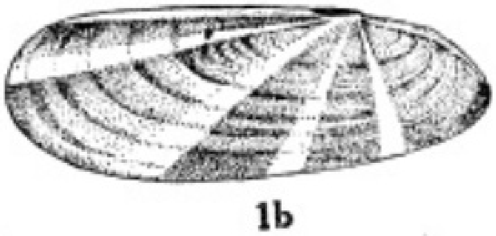

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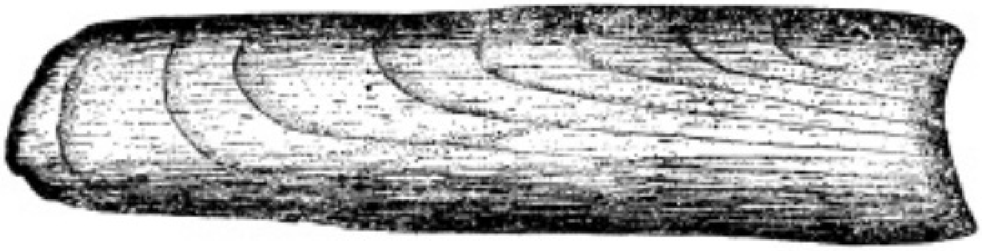

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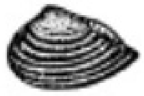

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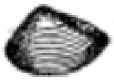

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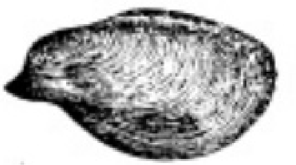

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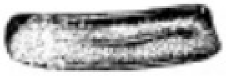

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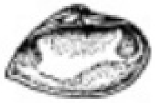

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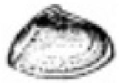

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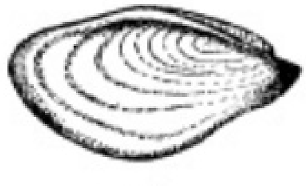

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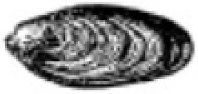

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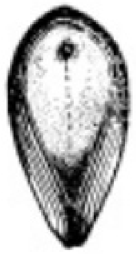

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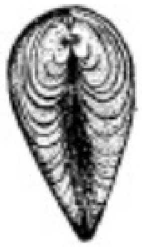

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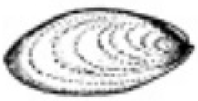

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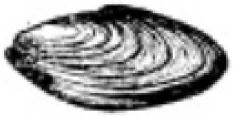

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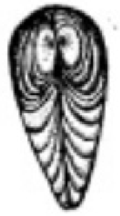

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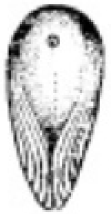

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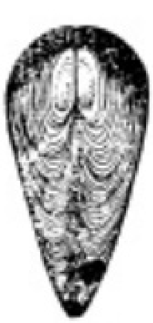

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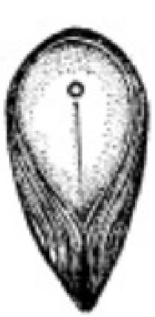

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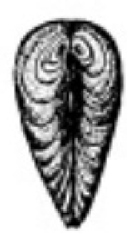

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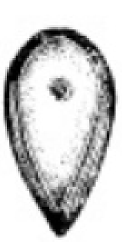
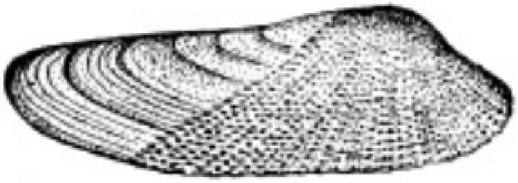


10c

PLATE XXV.

Fig. 1. *Pholas* (*Monothyra*) *orientalis* Gmelin × ½, (outer view).
" 2*a*. Piece of timber bored by numerous shells of *Martesia striata* (Linné).
" 2*b*. Single isolated shell of *Martesia striata* (Linné), (outer view).
" 2*c*. Single isolated shell of *Martesia striata* (Linné), (inner view).
" 3*a*. *Jouannetia globulosa* (Quoy & Gaimard), (outer view).
" 3*b*. *Jouannetia globulosa* (Quoy & Gaimard), (inner view).
" 4. *Jouannetia cumingii* (Sowerby), spirit specimen (outer view).
" 5. *Pholadidea* sp., spirit specimen, (outer view).
" 6*a*. *Laternula anatina* (Linné), (outer view).
" 6*b*. *Laternula anatina* (Linné), (inner view).
" 7*a*. *Laternula corrugata* (Reeve), (outer view).
" 7*b*. *Laternula corrugata* (Reeve), (inner view).
" 8*a*. *Brechites dichotomus* (Chenu), anterior end of tube, showing perforated disc.
" 8*b*. *Brechites dichotomus* (Chenu), entire tube with the minute bivalve shell attached to it.

PLATE XXV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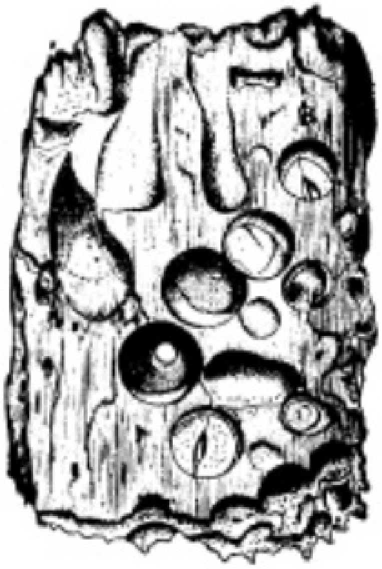
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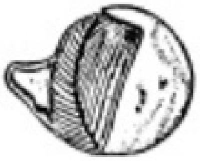
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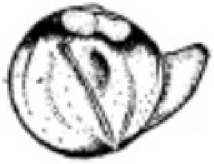
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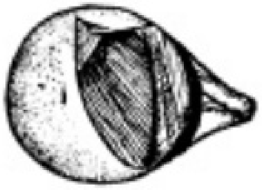
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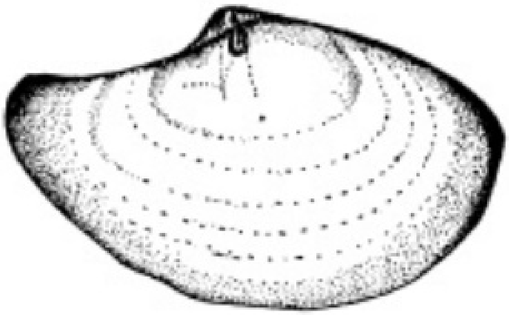
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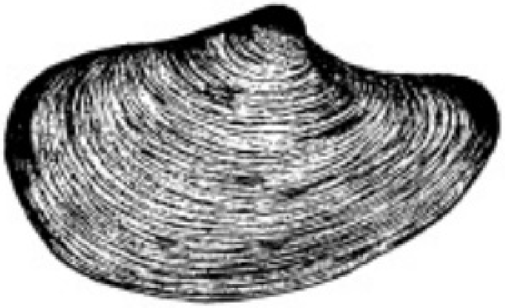
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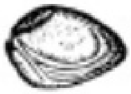
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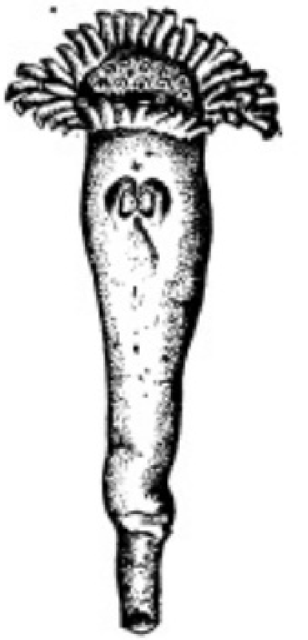
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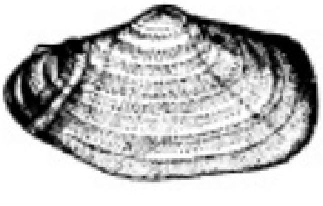
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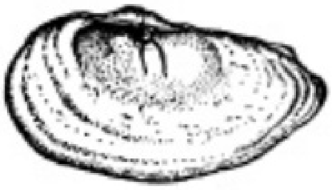
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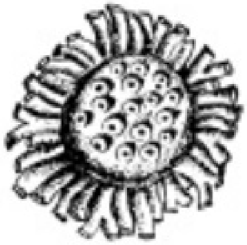

8a

PLATE XXVI.

Fig. 1*a*. *Spirula spirula* (Linné), (side view).

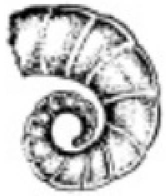
,, 1*b*. *Spirula spirula* (Linné), (apertural view).

,, 2*a*. *Sepiella inermis* (Férussac & d'Orbigny), (dorsal view of the cuttlebone).

,, 2*b*. *Sepiella inermis* (Férussac & d'Orbigny), (ventral view of the cuttlebone).

,, **3.** *Sepia rouxii* Férussac & d'Orbigny × ½, (ventral view of the cuttlebone).

,, **4.** *Sepia aculeata* Férussac & d'Orbigny × ½, (ventral view of the cuttlebone).



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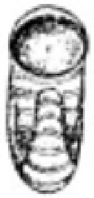

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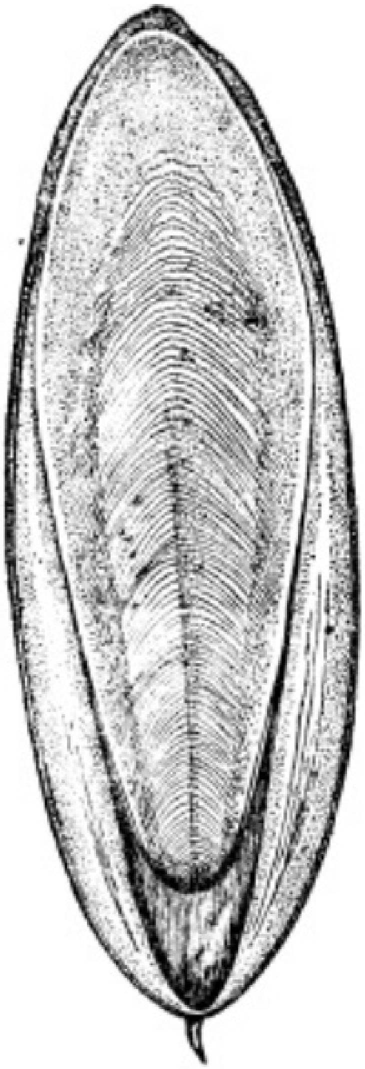

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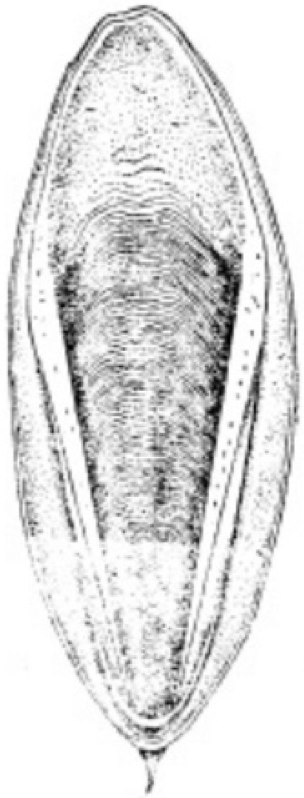

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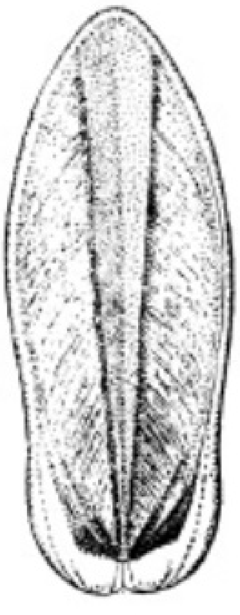

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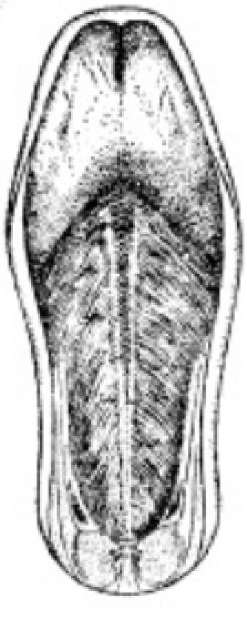

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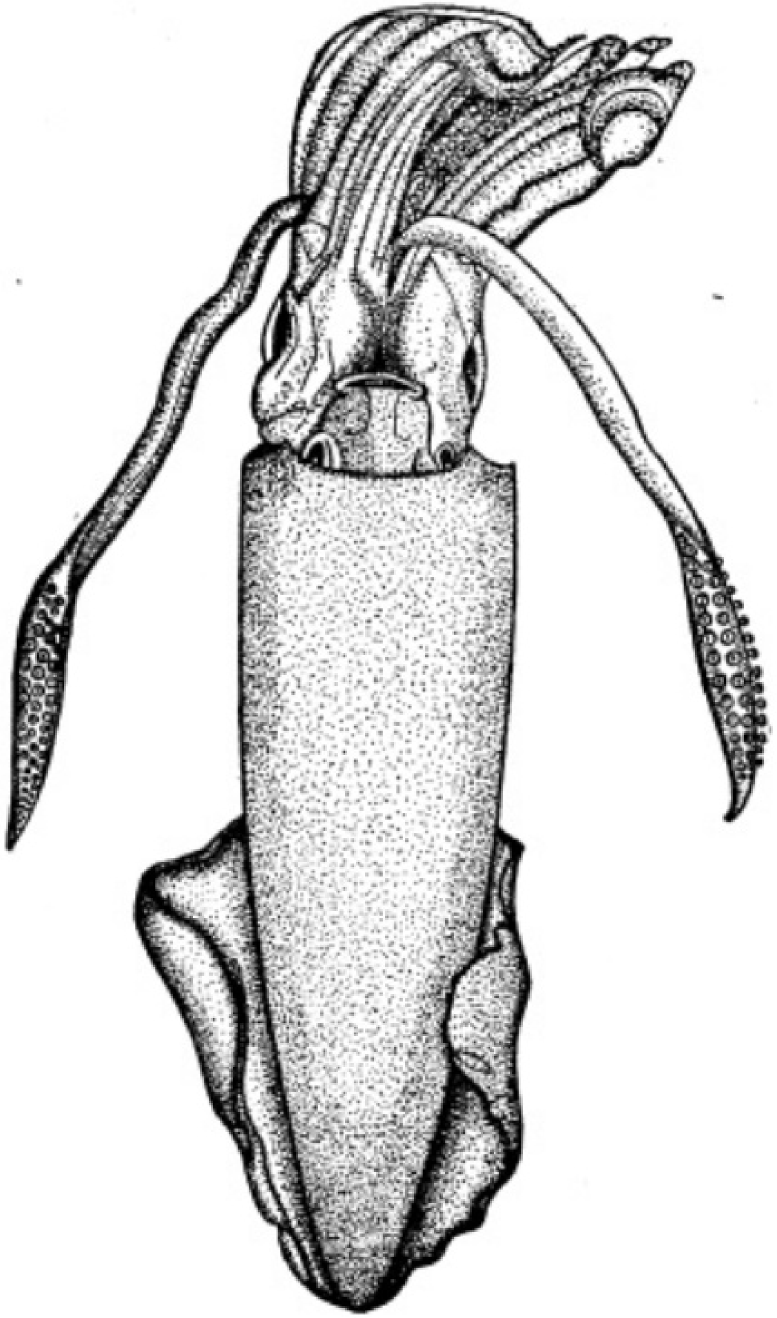
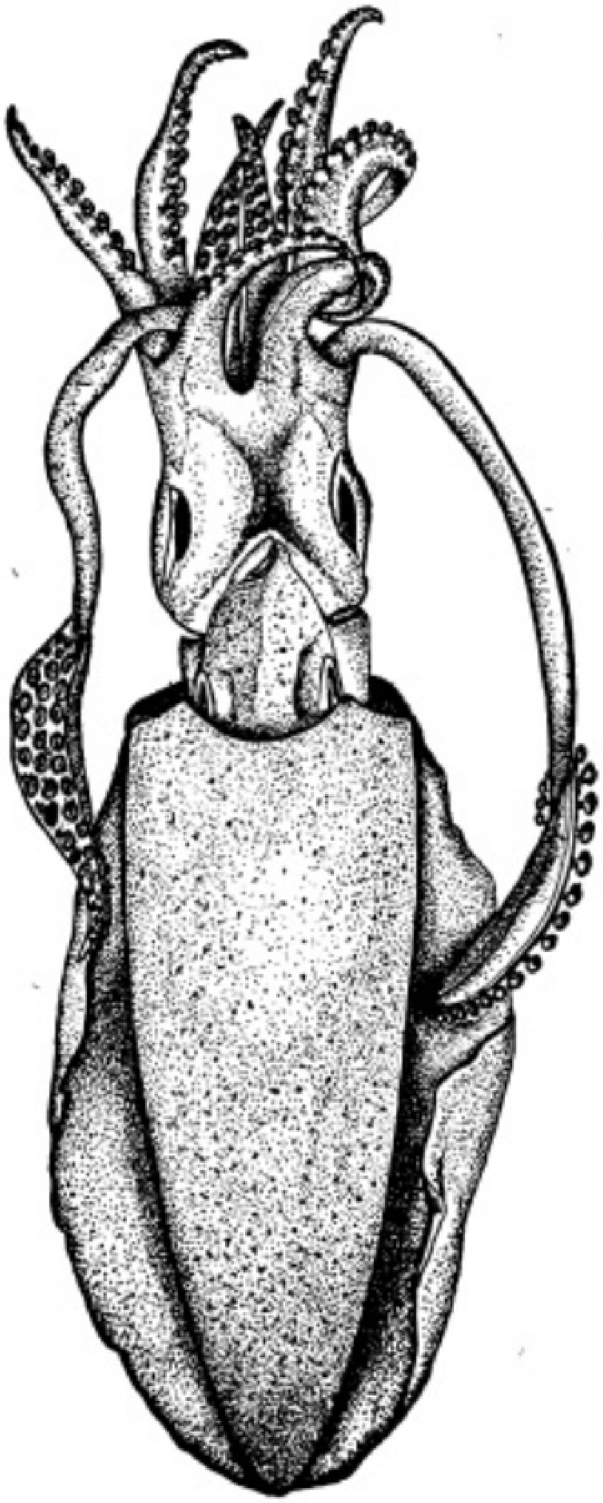
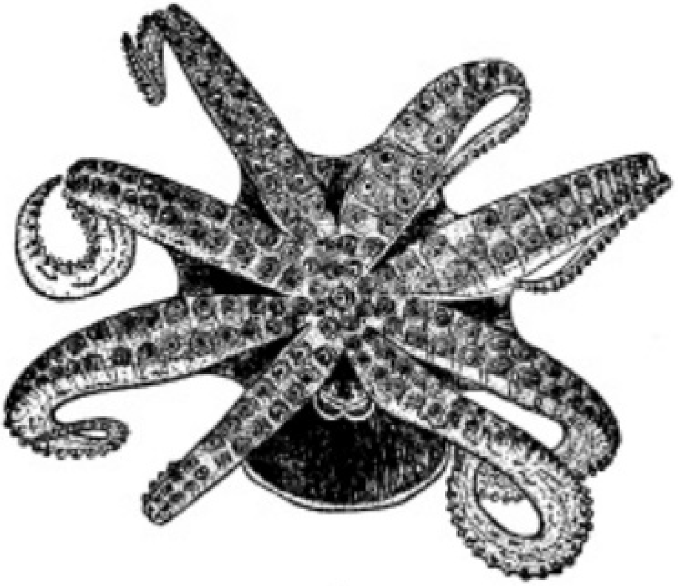
PLATE XXVII







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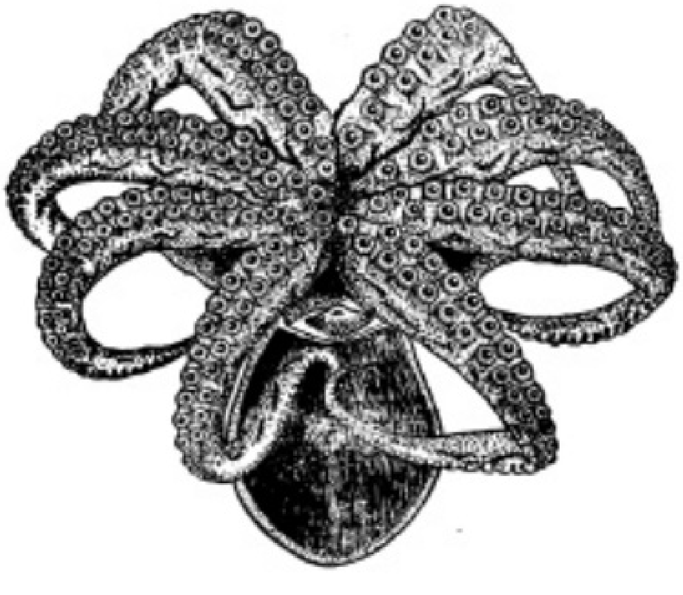

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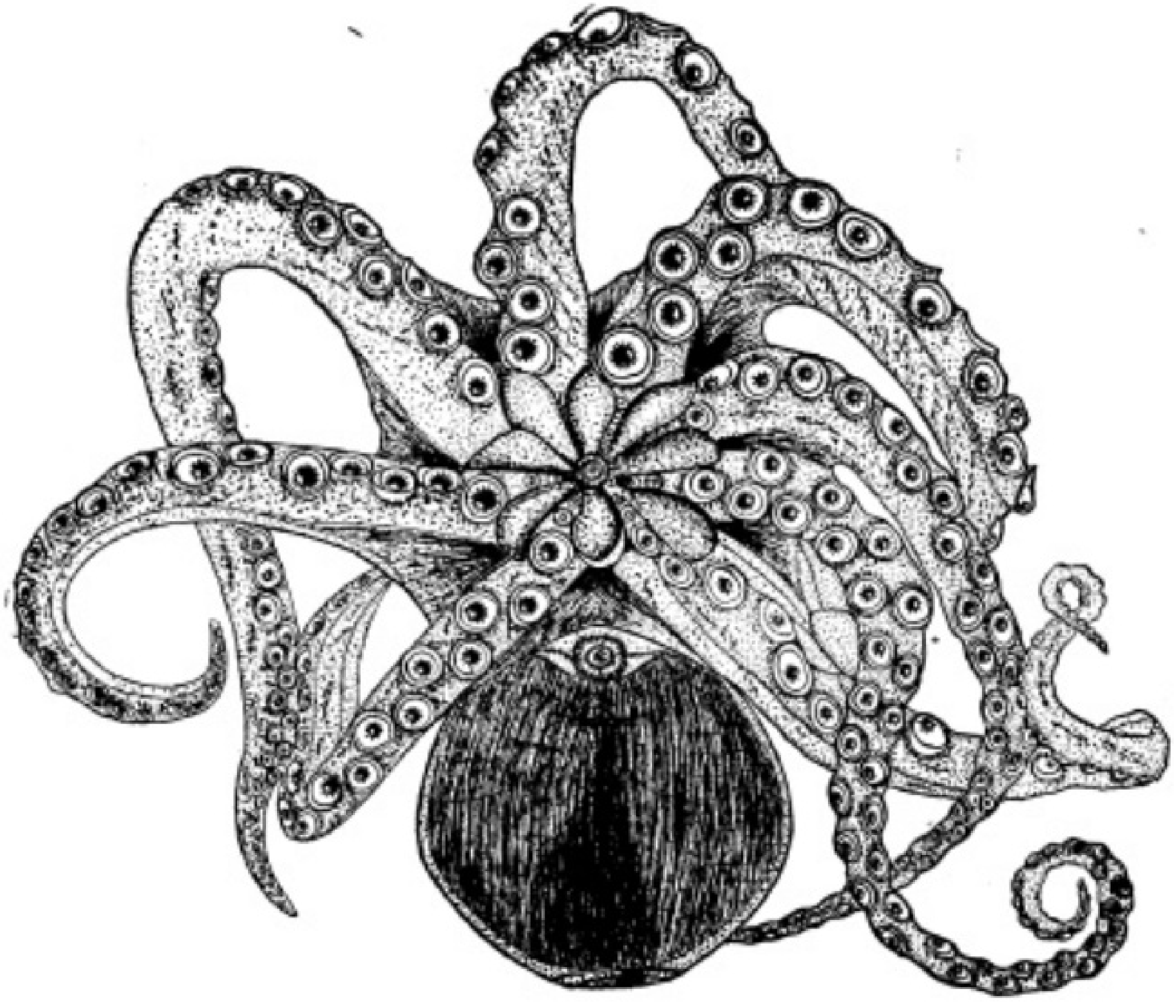

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